THE MIDDLE STONE AGE AT KLASIES RIVER, SOUTH AFRICA

by

Sarah Wurz

Dissertation presented for the degree of
Doctor of Philosophy at the
University of Stellenbosch
Promoter: Prof. H.J. Deacon

December 2000

Declaration

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree

ABSTRACT/ OPSOMMING

The Late Pleistocene, Middle Stone Age artefact sequence at the Klasies River main site, was studied to establish what information this held for inferences on the emergence of symbolic thought and communication. The approach adopted was to complement traditional typological analysis by a technological study of artefact production within the framework of the *chaîne opératoire*. The results show that technology was aimed at producing preformed blanks. In the choice of materials, the technique and method of blank production and the retouch of blanks, arbitrary or stylistic choices were made. Changes in stylistic conventions can be documented through the sequence. Changing conventions in artefact production show that the lives of the people who made the artefacts were structured in a symbolic web. These results together with evidence from evolutionary biology, show that by at least 115 000 years ago, people were able to think and speak symbolically. This African archaeological evidence for the emergence of symbolism, a defining attribute of modern peoples, is much older than previously considered.

KEYWORDS: Klasies River, Middle Stone Age, technology, symbolic communication, human evolution.

Die Latere Pleistoseen, Middel Steentydperk artefakte by Klasiesrivier vindplaas is bestudeer om te bepaal watter kennis ingewin kan word aangaande die ontstaan van simboliese denkwyse en kommunikasie. Die benadering wat gevolg is, was om tradisionele tipologiese analise te komplementeer met 'n tegnologiese studie van artefak produksie binne die raamwerk van die *chaîne opératoire*. Die resultate demonstreer dat tegnologie gemik was op die produksie van voorafgevormde skilfers. Die keuse van roumateriaal, die tegniek en metode van produksie en die herafwerk van skilfers is gelei deur arbitrêre stilistiese keuses. Veranderinge in hierdie konvensies kan gedokumenteer word deur die hele sekwens. Hierdie verandering is tipies van mense wie se lewens gestruktureer word deur 'n simboliese web. Dié resultate, en dié van evolusionêre biologie, dui daarop dat mense reeds teen 115 000 jaar gelede simboliese denke en spraak magtig was. Hierdie bewyse vanuit Afrika vir die ontstaan van simboliese gedrag is veel vroeër as vantevore gereken.

SLEUTELWOORDE: Klasiesrivier, Middel Steentydperk, tegnologie, simboliese kommunikasie, menslike evolusie.

CONVENTIONS

In line with other in-house research at the Klasies River sites the following conventions are adopted:

- Middle and Later Stone Age are not abbreviated to MSA and LSA.
- Klasies River and not Klasies River Mouth is the locality name.
- The site is referred to as Klasies River main site, and main site is not written in capitals.
- Cave is written in the lower case when referring to Klasies River sites, except at the beginning of a sentence.
- Member is written with a small m.
- Howiesons Poort is spelled without an apostrophe.
- All artefact measurements are in millimetres (mm) and the decimal point instead of the decimal comma is used.
- In the text, all measurements are rounded off to the nearest mm.
- Bar-scales are in units of 10 mm.
- Coefficient of variation (CV) is expressed as a percentage.
- Two samples are referred to as the SW-sample and the D-sample. The material excavated by Ronald Singer and John Wymer in 1967 and 1968 is referred to as sample SW, or SW-sample. The excavations by H.J. Deacon have taken place over a number of years since 1984. The material from these excavations is referred to as sample D, or D-sample. In Chapter 2, the history of the excavations and the stratigraphic sub-stages of the Middle Stone Age to which these two samples refer, are explained.

ACKNOWLEDGEMENTS

I am grateful to the numerous people who provided the groundwork for this study in excavating, sorting and counting of artefacts in the various stages of the fifteen years that the Deacon project has run. I would like to thank those who worked with me in the last two years in the Department of Archaeology at University of Stellenbosch for their enthusiasm and interest. The encouragement of Nicola Berrington, Zenobia Jacobs, René Rust and Liezl van Pletzen is much appreciated. Andrew Deacon is thanked for lending his computer skills in the preparation of the final text, photographs and figures. Mary Leslie has provided invaluable support and guidance through the past four years. My thanks and appreciation go to my promoter, Professor Hilary Deacon who has provided direction in spite of many other commitments. I have benefited from and developed my own thinking through his fund of ideas and insights.

The financial assistance of the National Research Foundation: Division for Social Sciences and Humanities and the Harry Crossley Bursary fund is gratefully acknowledged. The L.S.B. Leakey Foundation is thanked for their support of the research at Klasies River, the Struwig Trust is thanked for permission to work at Klasies River and the South African Museum is thanked for access to collections.

I would also like to thank my children, Wian and Jana, and especially my husband for unfailing support and much patience. My extended family was always there to provide moral support and assistance in keeping the home fires burning and my thanks go to them too.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Klasies River main site on the Tsitsikamma coast is one of the major Late Pleistocene archaeological occurrences (Allsworth-Jones 1993). It is a 20 m sequence of well stratified deposits, dating to between 120 000 and 60 000 years ago, that has yielded remains of early anatomically modern humans in association with Middle Stone Age artefacts, animal bones and shell. Although the main claim to fame is the human remains, the site documents amongst the earliest use of marine resources and is rich in a wide range of finds. There is a considerably body of literature (Butzer 1982; Singer & Wymer 1982; Binford 1984; Deacon H.J. 1992, 1995) on the site, published in technical journals and books, and this has made it well known. Studies of materials excavated from the site (Klein 1976; Avery 1987; Deacon *et al.* 1988; Milo 1994) have contributed to debates in fields ranging from geochronology, taphonomy, human evolution and archaeology. In many instances the starting point for these debates is by reference to the data from Klasies River main site.

The 1980s saw the application of molecular biological techniques to the problem of the study of modern human origins (Wainscoat *et al.* 1986; Cann *et al.* 1987). This stimulated the formulation of the 'Out-of-Africa' hypothesis that holds that the origins of all modern humans was in Africa and dispersal out of this continent led to the replacement of other archaic populations or different demes elsewhere (Stringer & Andrews 1988). This hypothesis in its many variants has come to dominate thinking about recent human ancestry. It is in this context that the well-dated human remains from Klasies River become important as they show the presence of modern people in Africa considerably earlier than in Europe and as early or earlier than elsewhere in Africa (Foley & Lahr 1997). This does not imply that southern Africa was the centre of evolution of modern people, but it does support the contention of the Out-of-Africa hypothesis that the primary dispersal of modern humans was in Africa.

The debates on modern human origins have been in the fields of molecular biology and human palaeontology rather than archaeology. This is because artefacts, the basis for archaeological inference, do not carry incontrovertible evidence of who made them. For example, people who are genetically and physically closely related may make very different kinds of artefacts. The contribution of archaeology to the debate has been to map the dispersal of modern humans and to provide details of dating and the associations of the human fossils.

There is another area in which archaeology can make a contribution and that is in the study of evidence for past human behaviour. Archaeology is uniquely positioned for the study of the evolution of the mind and symbolic thinking (Chase 1994). On one level this dissertation is concerned with the Late Pleistocene evidence for the emergence of symbolic behaviour and, on another, it is concerned with the evolution of the modern mind. This is the reason for developing a discussion on the brain, the mind and behaviour from an evolutionary perspective. Behaviour cannot be studied as something divorced from its biological embodiment (Edelman 1992; Lewontin 1997; Greenberg *et al.* 1999) and for this reason a physicalist philosophical view (Kim 1998) is adopted here. If the makers of Middle Stone Age artefacts were physically modern, did they also have the capacity to think symbolically and communicate through speech?

A widely held view (Klein 1995; Ambrose 1998a) is that early modern humans in Africa associated with the Middle Stone Age were not neurologically modern and the capacity for modern behaviour appeared as recently as 50 000 years ago. This later modern behaviour (LMB) hypothesis attempts to marry conventional thinking about the Middle to Upper Palaeolithic transition in Eurasia with the newer evidence of the African origins of modern humans. The dictates of Occam's razor suggests a simpler hypothesis. This, the earlier modern behaviour (EMB) hypothesis, is that the evolution of modern thinking, modern minds and modern or symbolic behaviour were interrelated and part of the same process, that was initiated in the Middle Pleistocene. This evolutionary process is detailed in Chapter 7.

The data assembled for the discussion of these broader issues and the test of the validity of these hypotheses, come from the detailed study of samples of stone artefacts. The long stratified sequence at Klasies River has provided a temporally seriated set of artefact samples that show changes in the types of artefacts made in the Middle Stone Age. The term Middle Stone Age, introduced some 70 years ago by pioneer archaeologists John Goodwin and "Peter" van Riet Lowe, still has currency as a technological stage division. It was first demonstrated in the Klasies River sequence that a distinctive sub-stage, the Howiesons Poort, characterised by the occurrence of backed artefacts, was stratigraphically positioned in the middle and not at the end of the sequence. Previous assumptions that the Middle Stone Age showed a simple linear change of improving technology that culminated in the Later Stone Age-like artefacts of the Howiesons Poort were clearly false. Re-evaluation of the Middle Stone Age artefact sequence started with the 1967/8 excavations at Klasies River and this has stimulated research at other like-aged sites elsewhere in Africa.

The artefact samples from Klasies River main site have been analysed specifically for the evidence they may provide on symbolic communication. Artefacts are material culture and in making and using artefacts symbolic communication is expressed through tangibles like material culture as much as intangibles like speech, song and dance. Where the form of artefacts or their manufacture can be shown to have changed in time as a result of arbitrary stylistic conventions, then symbolic communication is implied. Symbolic communication in turn implies the capacity for all forms of modern behaviour.

CHAPTER TWO

HISTORICAL PERSPECTIVE ON THE KLASIES RIVER INVESTIGATION

Singer & Wymer: 1967/8 excavations

Background

There are several claimants to the recognition of the archaeological significance of the Klasies River site (34.06°S, 24.24°E) (Fig. 1). Ludwig Abel, a Port Elizabeth businessman and recreational mountaineer who was interested in rock art, is one claimant (Singer & Wymer 1982). Another is Paul Haslem (*pers. comm.*), who regularly fished along that section of coast and who reported the Klasies River site (Fig. 1) to Port Elizabeth Museum where his wife was employed. In 1961, during a South African Museums Association meeting held at the Port Elizabeth Museum, arrangements were made for the physical anthropologist, Ronald Singer, and the archaeologist, Ray Inskeep, both then on the staff of the University of Cape Town, to visit the site. Exposures showed Middle Stone Age artefacts and bones cemented to the cliff face.

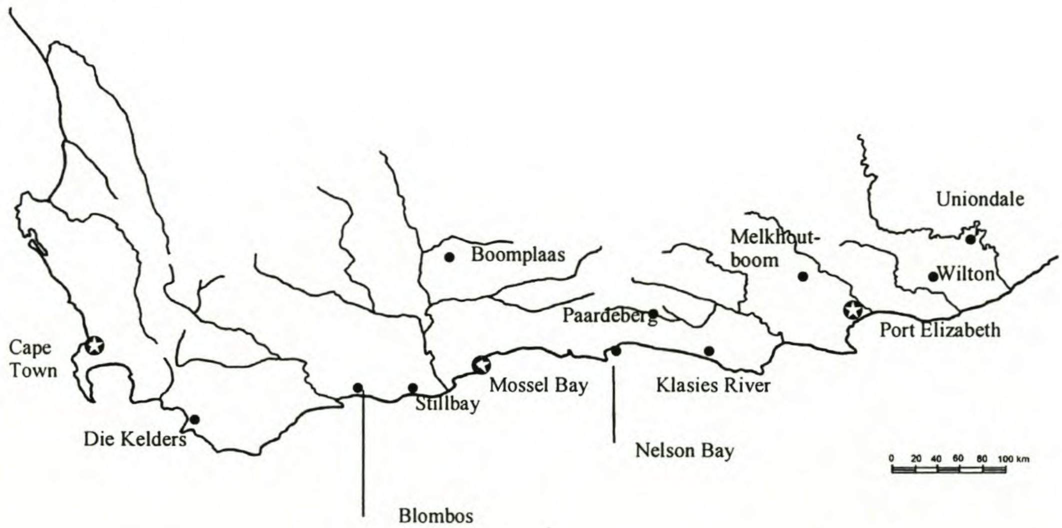


Figure 1. Location of Klasies River and sites mentioned in the text.

Singer had trained in the medical school at the University of Cape Town under Drennan and had developed an interest in human evolution. He had discovered the Elandsfontein fossil site and with Drennan he undertook the description of the 'Saldanha' calvarium found there in 1953 (Singer & Wymer 1968). His interests extended to the evolution of the Khoisan. His reassessment of Boskop (Singer 1961) and other then available human palaeontological finds showed that Khoisan history was poorly documented in the fossil record. While the San could be associated with the Later Stone Age, there was few, if any fossils that could be associated with certainty with the Middle Stone Age. New finds were needed from well-stratified and dated contexts to inform on the evolution and antiquity of the Khoisan. Therein lay the potential importance of the Klasies River sites.

In 1967, Singer assembled a team, funded through the University of Chicago, to excavate at Klasies River sites. John Wymer, an archaeologist from the Reading Museum, led the team and the direction of the excavation was his responsibility. Over a two-year period in 1967 and 1968, Wymer and his team spent 14 months in the field and carried out extensive excavations. There was a conscious aim to contribute to the understanding of the Middle Stone Age and to recover human remains. The excavation was successful on both counts, but in the process a considerable volume of deposit was removed.

Although the fieldwork was completed in 1968, it was not until 1982 that the monograph, *The Middle Stone Age at Klasies River Mouth in South Africa*, appeared. The basis of the monograph was Wymer's field notes with the addition of chapters on the sedimentology by Butzer, the shellfish remains by Voigt and isotopic dating by Shackleton. Klein (1976) who undertook the study of the large mammal fauna, had published his analyses prior to the appearance of the monograph and his results were only included in summary form. Singer who, with Wymer, had a primary role in editing the publication, undertook the description of the human remains.

Stratigraphy and archaeological finds

What became known as the Klasies River Mouth caves are not at the mouth of the river. The sites are between 0.5 km and 1.5 km to the southeast (Fig. 2). The most extensive excavations (Singer & Wymer 1982) were carried out at what is now termed main site, a single depository against a cliff face with several openings into the cliff. Main site was described as including caves 1, 1B, 1C and shelter 1A (Fig. 3), but the deposits are or were continuous between these entities. These designations are useful to refer to different parts of main site. For simplicity no distinction is made between caves and shelters. Main site (Deacon, H.J.1995) is technically an open site, even though some of the occupation deposits extend into the cave-like openings in the cliff. The cone of deposit that once filled the main site depository has been truncated by erosion and perhaps only a quarter of the original volume remains. However, it is still an impressively large site with a deep sequence of layered deposits exposed.

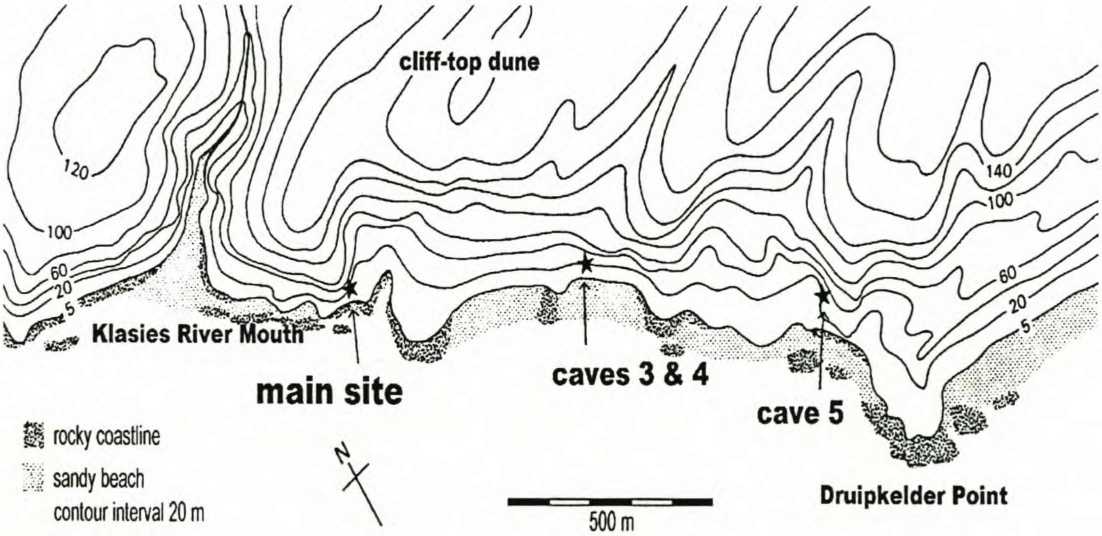


Figure 2. The setting of Klasies River sites.

The excavations (Singer & Wymer 1982) were begun in the eastern half of the cave 1 and an initial cutting was excavated up the slope above in cave 1A (Fig. 3). A 'trench' was made to connect these excavations to the edge of the rock platform. Subsequently, the excavations in cave 1 were extended to include the western part, leaving only a central witness baulk unexcavated. The initial cutting in cave 1A was widened as the top, middle, bottom and side cuttings. Not all the cuttings in cave 1A were sunk to bedrock, but elsewhere they reached the base of the sequence. Further test cuttings were made in caves 1B and 2 at main site, in a nearby but separate small shelter 1D, and in cave 5 near Druipkelder Point. It is the excavations at main site that are the primary concern of this dissertation.

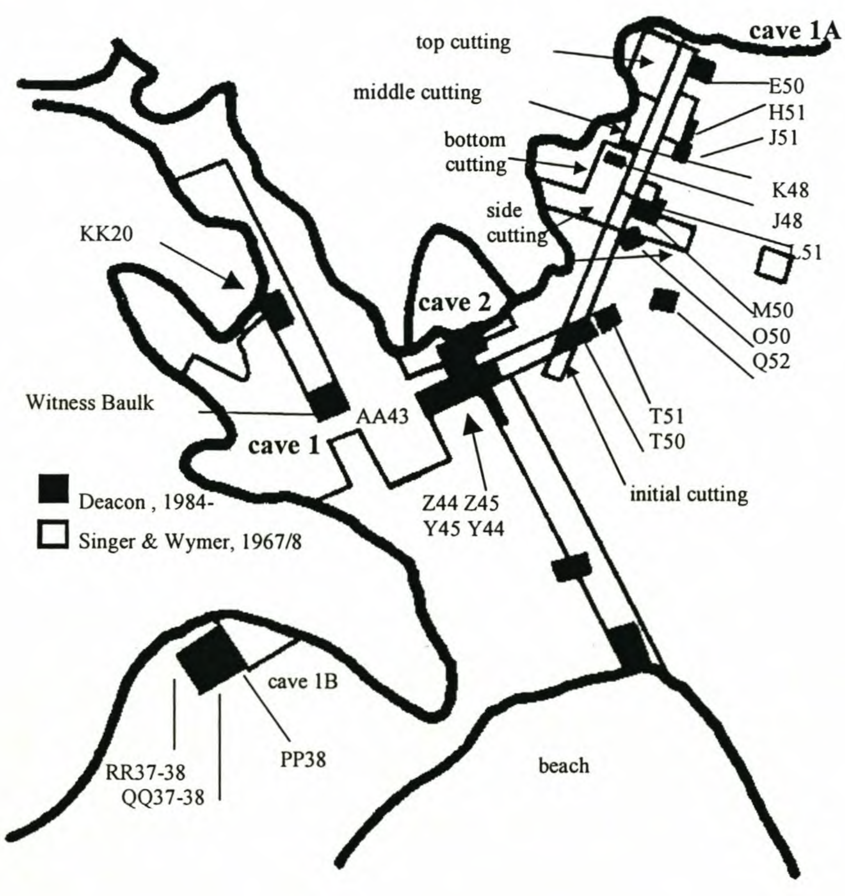


Figure 3. Klasies River main site plan showing the numbering of the squares excavated since 1984.

Within the caves at main site, the areas excavated were defined as blocks or cuttings rather than squares (Singer & Wymer 1982:fig.2.1). Finds were not routinely plotted, nor were features like hearths recorded. The strata were excavated in layers, following the stratigraphy. The layers were spits of varying thickness from 100 mm to more than one metre. These were defined on lithology in some instances, and by arbitrary convenience in other instances. Layers were given numbers that related to particular cave areas. The artefact contents were used to group the layers into a cultural stratigraphy.

The cultural stratigraphy defined by Singer & Wymer (1982) included four Middle Stone Age divisions and the Howiesons Poort. The basal division was the MSA 1 and this was defined on the frequency of distinctive bruising on the platforms of the flaked products. The MSA 11 occurred in the overlying layers, below the layers containing the typologically distinctive, segment-rich Howiesons Poort. In cave 1A, a metre or more of deposit containing MSA lll artefacts overlay the latter layers. The MSA lV was restricted in occurrence to Layer 13 in cave 1.

The numbering of sub-stages in the Middle Stone Age in chronological order was a departure from the tradition of naming variants or variations (Goodwin & Van Riet Lowe 1929) after type-sites. The justification offered (Singer & Wymer 1982:87) was the lack of precision in the definition of the traditionally recognised variants. The exception was the Howiesons Poort where the type-site name was retained because comparisons could be made to the type-site collection. Singer & Wymer (1982:114) considered that the Howiesons Poort artefacts were significantly different from those made by the people of the Middle Stone Age and argued that the Howiesons Poort artefacts indicated an intrusion of a people with a different lifeway. This rests on the assumption that different sets of artefacts represent different peoples or tribes. Evidence detailed in this study is a conclusive demonstration that the Howiesons Poort is not intrusive, but is an integral part of the Middle Stone Age stage (Wurz 1999).

The artefacts were analysed in the field and there was no opportunity for any extended laboratory study. A conventional typlogical approach was used in the analysis. The materials were classed as cores, flakes and flake-blades and worked pieces, with low frequency items in minor classes like scrapers, gravers and hammerstones. Notable among the rarer finds were pieces of ground ochre and worked bone.

The quantities of artefacts recovered from this extensive excavation were so large, well in excess of 250 000 pieces, that only samples of the finds from some cuttings were retained. This would not be an acceptable procedure under current research protocols. A further bias was introduced in the use of relatively large screens in sieving and the finer artefactual component, mostly chipping debris, was not recovered. The different collection and recovery practices adopted means the artefact samples from different parts of the sites do not have the same value for analysis. The total sample is considerable and this is an advantage. The selective retention of artefacts and fauna has resulted in some loss of information. However, while the sampling design limits, it does not negate the study worthiness of the 1967/8 Singer & Wymer sample (SW-sample).

As the deposits are well stratified and the spits were excavated following the layering, the sequence of the layers is clear. However, there are problems in the interpretation of stratigraphy in cave 1. From examination of the drawn sections (Singer & Wymer 1982: fig. 3.2), it is apparent that Layer 14 is not a coherent stratigraphic unit. It was defined on its clast-rich lithology and overlies and underlies, or is a facies of layers 15, 16 and 17 in different sections. The clast-supported matrix has developed locally where the finer sediment have been elutriated by the post-depositional drainage of ground waters through the deposit. This means that the precise stratigraphic provenance of materials assigned to these layers may be uncertain. The artefacts from these layers are from the same Middle Stone Age sub-stage. This limits potential confusion, but resolution is reduced. The problems in interpreting the stratigraphic provenance of materials associated with Layers 14 to 17 are pertinent to the discussion of the context of the finds of human remains in cave 1 (Fig. 4). These appear to be associated with Layer 16 rather than to have been distributed between layers 14 –17 (Deacon, H.J. 1995). Layers 16 and 17 are primary human occupation horizons and from Layer 15 upwards in the sequence they are slope deposits. The problem is also pertinent in the provenance of a denticulated bone artefact, 27069, from Layer 15 where disturbed by Layer 14 (Singer & Wymer 1982:115) as discussed in Chapter 6.

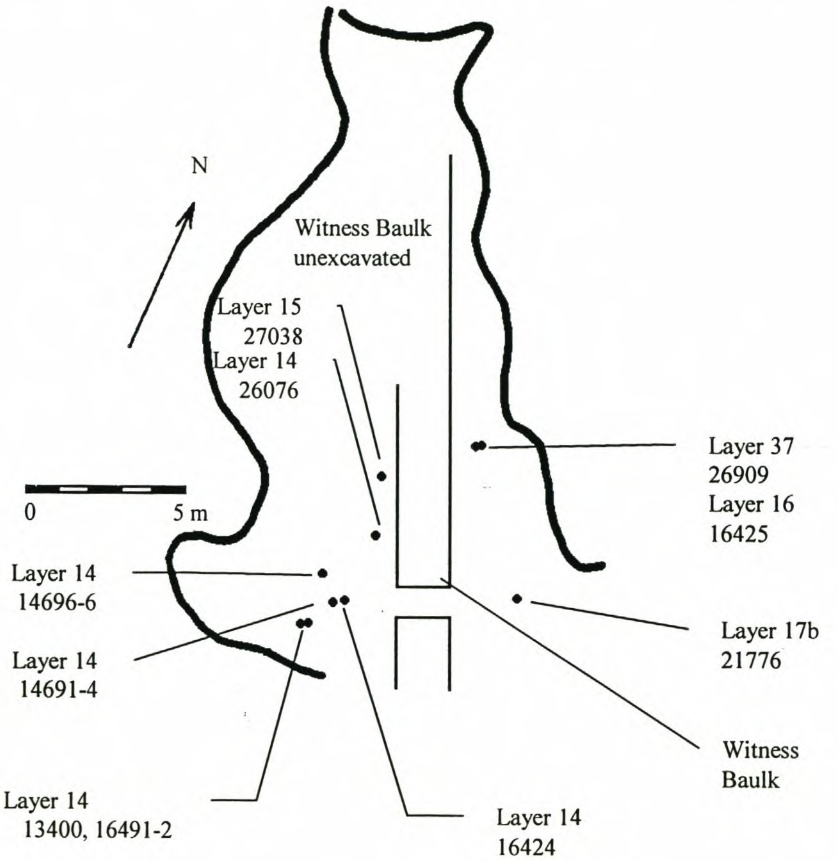


Figure 4. Plot of human fossil finds in the SW-sample, cave 1A (after Singer & Wymer 1982).

The resolution of the stratigraphy in cave 1 also has a bearing on the interpretation of the fauna as only carnivores would have used cave 1 when it became blocked by slope wash. It also has a bearing on the context of the artefact materials represented in Layer 13 and assigned to the MSA 1V. Erosion has removed any primary occupation to which these materials may relate and their younger stratigraphic position in the Middle Stone Age sequence, which appears acceptable, was inferred from the typology of the artefacts, rather than the stratigraphy.

Dating

Singer and Wymer (1982) obtained a number of radiocarbon age estimates for the deposits. These estimates were found to be stratigraphically inverted with finite estimates obtained for samples stratigraphically below samples with infinite ages. Such inconsistencies are due to contamination by younger carbon at or beyond the limits of the method. This was evidence that the whole sequence dated to more than 40 000 years. Through collaboration with Bada and Deems (1975) amino acid age estimates of 110 000 years (Layer 38), 85 000 years (Layer 37), 84 000 years (Layer 16) and 61 000 (Layer 13) were obtained. These age determinations were made on bone, which is not the preferred material of most analysts. However, the results suggested the Middle Stone Age deposits dated to more than 60 000 years. Shackleton obtained the most significant age estimate reported by Singer & Wymer (1982), in his analysis of the oxygen isotope ratios in turban shell opercula. The operculum analysed from the base of the sequence yielded a range of values indicating the shell grew in waters as warm or warmer than the present. Prior to the Holocene, it was in the Last Interglacial, Marine Isotope Stage (MIS) 5e, that such conditions would have been met, suggesting an age of 125 000 years. Shackleton analysed selected samples from higher in the sequence, but these results had less readily interpretable implications for dating the deposits. It was the dating results that had been obtained that prompted Singer & Wymer (1982:149) to claim that the human remains, notably the most modern looking specimen from cave 1B, were older than 100 000 years.

The implication for the dating of the Middle Stone Age artefact sequence was that it fell in the first half of the Late Pleistocene (125 000 – 65 000 years). Uncertainties in the dating of the Howiesons Poort layers remained. Partly on geomorphological considerations and partly on the faunal evidence (Klein 1976), Butzer, in his contribution to the Singer & Wymer monograph, correlated the Howiesons Poort levels with MIS 5b at about 95 000 years old. The large mammal fauna (Klein 1976), from the Howiesons Poort and MSA lll layers, indicated an open environment that would be expected in a cooler stadial, when there was a regression in sea level. If this were in MIS 5 then the possibilities were 5d or 5b, with MIS 4 a further possibility. Shackleton's suggested age was 50 000 years as he correlated the Howiesons Poort levels with MIS 3. The mammal fauna associated with the MSA 1, like the Howiesons Poort layers, also indicated open habitats and Klein considered the possibility that the base of the sequence could fall in MIS 6, the Penultimate Glacial. There were some uncertainties about the dating of the artefact sequence and Binford (1984) exploited these in an attempt to argue for ages for the Howiesons Poort artefacts and the human remains from cave 1B that were more consistent with the dating of the beginning of the European Upper Palaeolithic.

Interpretation

In their interpretation of the evidence from the site, Singer & Wymer (1982) stressed the abundance of resources, particularly marine resources, as the key to the continuous or near-continuous human occupation. Only in the Howiesons Poort did they see a hint of changes in activities with the influx of different peoples with different hunting technology and methods designed to hunt smaller game of open country (Singer & Wymer 1982:208). Although the presence of red ochre throughout was recorded, these authors saw little in the finds to suggest that spiritual activities (Singer & Wymer 1982:210) may have been involved in cementing Middle Stone Age society together. They emphasised continuity and stability over millennia. By interpreting changes in artefact styles in functional terms, investigation of Middle Stone Age mentality or spiritual values was precluded.

Klein's (1976) analysis of the large mammal fauna drew further attention to the site. He provided numerical data on the species composition, body part representation and age distributions that were amenable to interpretation in different ways. He argued that the fauna, dominated by large bovids like buffalo, eland and extinct giant buffalo, showed the hunting of prime adults of docile game and only the young or old of more dangerous species. This indicated to him that Middle Stone Age people were unable to use the resources of their environment as effectively as Later Stone Age people. In addition, he pointed to the absence of evidence for fishing and fowling in the Middle Stone Age.

These arguments on Stone Age economics have been used to suggest that Middle Stone Age people like their Neanderthal contemporaries in Eurasia, were not modern in their behaviour. This is a position he continues to hold and his 'neural hypothesis' (Klein 1992, 1995) is discussed in more detail in Chapter 7.

An attempt was made by Binford (1984) to reinterpret the evidence provided by Singer & Wymer (1982) on the stratigraphy and dating and by Klein on the fauna. He did not visit the site but studied relevant faunal collections in the South African Museum. Binford interpreted the site as a sheltered place near a water-hole where food, obtained through scavenging, was consumed but not shared. He conceded that towards the top of the sequence, the hunting of small bovids as opposed to scavenging became more important. This was in line with his thinking that archaic kinds of people were scavengers and that people only became hunters with the advent of the Upper Palaeolithic and the appearance of modern people. As scavengers the people living at main site were not modern in their behaviour. The views of Binford have not been influential because of his extreme position in the discussion of hunting versus scavenging and because he was not fully conversant with the evidence from the site (Deacon, H.J. 1985).

In summary, the 1967/8 excavation, and the investigations that followed out of it, established Klasies River main site as a major archaeological occurrence. Although formal publication of the fieldwork was delayed, some information was widely available through general discussions in specialist reports like those of Butzer (1978) and Klein (1976). An important result was that the position of the Howiesons Poort sub-stage, within and not at the end of the Middle Stone Age culture-stratigraphic sequence, was established. The original investigators provided a picture of people living for many thousands of years in a bountiful coastal environment, little changed in their behaviour. The conclusion that Klein drew from the fauna was that the behaviour of Middle Stone Age people, like that of Eurasian Neanderthals, was non-modern.

Deacon: 1984-1999 investigation

Background

The re-investigation of the Klasies River sites was initiated in 1984 by H.J. Deacon and is continuing. This dissertation is part of the re-investigation. The reasons for the renewed research at the site were twofold (Deacon, H.J. 1995). Firstly, the sections of the 1967/8 excavation were unprotected, and by 1984 had suffered major collapses. The rehabilitation of the sites became a priority. Secondly, there was a need to gain more contextual details on the finds, to obtain more precise age estimates for the deposits and to obtain unselected samples of artefacts and fauna. The re-investigation became an extension of Late Pleistocene research at Boomplaas Cave in the Cango Valley.

The research was designed to sample a column through the sequence exposed in the Singer & Wymer 1967/8 excavation. The emphasis has been on sampling the contents in microstratigraphic units, using 3 mm or finer meshed screens to recover the smaller items like chipping debris and microfauna. In the interests of conservation, the volume of deposits excavated has been kept to a minimum, and the contextual detail of the finds emphasised. The artefact samples are small relative to those available from the 1967/8 excavations. In this study, where necessary, the sample (D-sample) has been amplified by reference to the latter (SW-sample).

Although this study is primarily of the artefact content of the deposits, it does benefit from the improved knowledge of the context and dating of the artefacts. The deposits have built up by multiple short-term human occupations separated by non-occupation deposits, usually sands. Occupation was episodic. The occupation horizons always include hearths and artefacts, but artefacts may also occur in the non-occupation interbeds where they have been eroded from high lying deposits. The strata are compacted by the decay of organic materials, plants and shell principally, and overprinting of one occupation layer on another is common. This accounts for the high artefact densities, as stone artefacts do not suffer from diagenetic alteration. The negative result of compaction is that it is less easy to distinguish individual occupation surfaces and to distinguish between occupation areas and dumps of food waste. The nature of the site and the limited scale of area excavated, has focussed attention on documenting changes in artefacts and other finds in time rather than space.

Stratigraphy and archaeological finds

Upper and RF members (MSA lll and the Howiesons Poort)

The 1984 excavations at main site started at the top of the *in situ* deposits in cave 1A in square E50 (Fig. 5) to sample the levels overlying those containing Howiesons Poort artefacts. The metre square E50 sampled the layers equivalent to those numbered 1-9 by Singer and Wymer (1982:18-19) and designated as MSA lll.

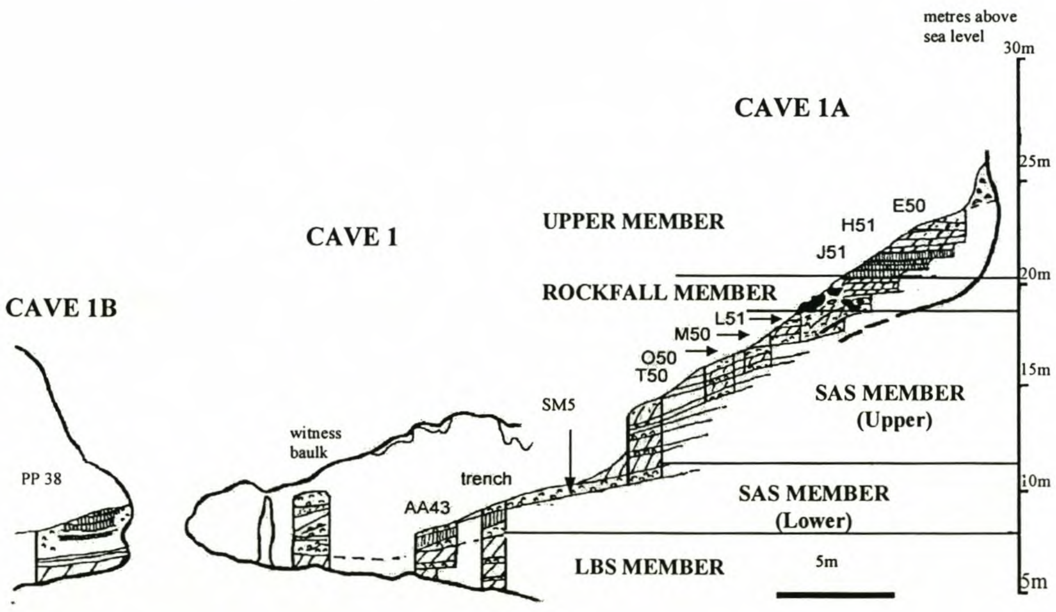


Figure 5. Stratigraphy of cave 1A sequence (after Deacon & Geleijnse 1988).

The stratigraphy indicated many more discrete units than they recognised and that non-occupation or culturally sterile layers become progressively thicker towards the top until the site was no longer inhabited (Fig. 6). The overlying scree deposits (Deacon & Geleijnse 1988) indicate a subsequent long hiatus in occupation at a stage when the depository was effectively filled. The MSA lll sample from the 1967/8 excavation is limited and even combined with the D-sample is somewhat inadequate for the description of the post-Howiesons Poort sub-stage in the sequence.

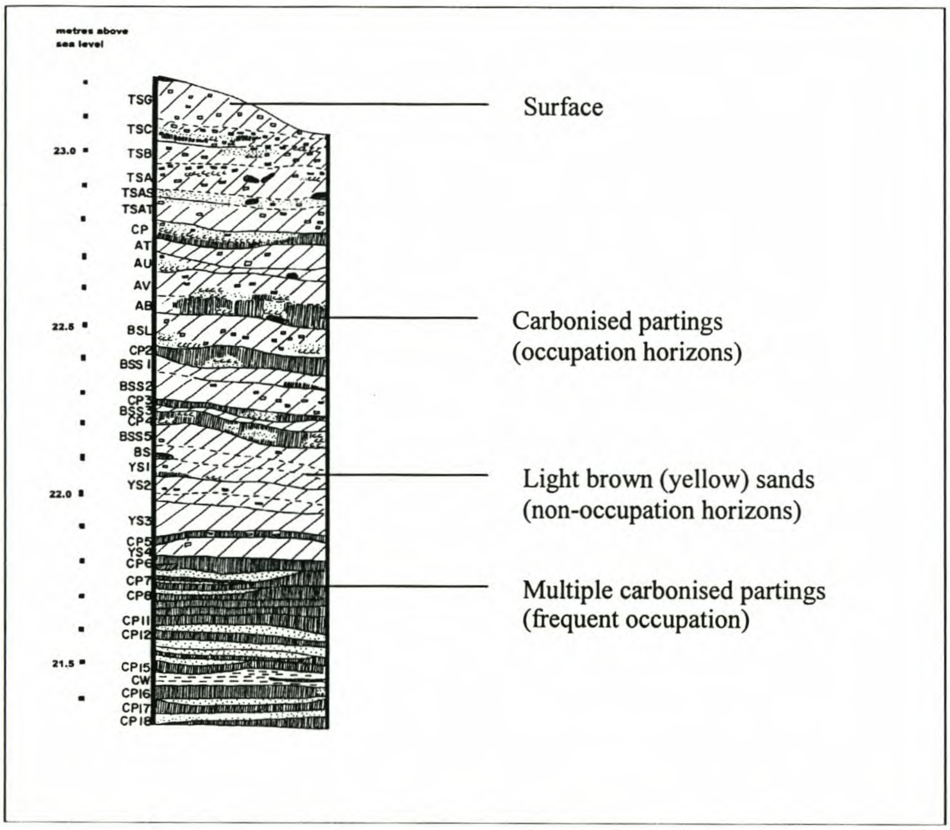


Figure 6. Stratigraphy of square E50, showing the labelled excavation units.

The Howiesons Poort levels, the equivalent of layers 10-21 (Singer & Wymer 1982) were sampled in squares H51, J51 and part of E50 (Fig. 5), all less than a square metre in area. These squares were excavated to establish the stratigraphic sequence and only adequately sample the more abundant contents like shell and microfauna. The small artefact sample is complemented by the very large sample excavated by Singer & Wymer (1982) from their top cutting for analysis.

The Howiesons Poort layers continue in cave 2. The surface of cave 2 is a lag deposit of artefacts being actively eroded from remnant *in situ* deposits. The cave 2 deposits (Deacon & Wurz 1996, Wurz 1999) were sampled by sweeping up this lag accumulation to obtain an unselected sample of artefacts for comparison with those excavated from the top cutting in cave 1A.

The excavated units in the squares E50, H51 and J51 have been grouped in the Upper member (Table 11, Appendix 1; Fig. 39, Appendix 1). They are a series of carbonised partings with ash and shell-rich lenses separated by layers of yellow oxidised sands rich in microfauna (Fig. 7). In H51, the charring of original organic plant-rich material tends to mark the culturally sterile sand interbeds, giving the impression that the sequence is composed of dark bands. The contrast is with the underlying thick yellow brown sand (Layer 22 of Singer & Wymer), with minor carbonised partings that has been designated the Rock Fall (RF) member (Fig. 5).

Figure 7. Howiesons Poort layers, 1967/8 top cutting.

The base of square J51 intersects the top of RF member. The sediments in the RF member include large blocks of dripstone that fell, possibly in a single collapse, at the end of this accumulation. Although less than 0.5 m thick, the sediments are largely a natural accumulation rich in microfauna from owl pellets. This deposit would have accumulated slowly and represents an extended period of very low intensity of human occupation. That an extended time period is involved is evident from the analysis of the artefacts undertaken and discussed in Chapter 5. This is because linear stylistic trends in, for example, raw material usage through the whole sequence are interrupted in the RF member. The trends continue in the overlying layer, but show a marked progression. Excavation in the sediments of the RF member has been limited to the initial cutting of Singer & Wymer and J51. The deposits are not well exposed and the artefact samples are too small to be informative.

SAS member (MSA ll upper & MSA ll lower)

In contrast to the RF member, the underlying sediments grouped in the SAS member (Fig. 5) are a thick accumulation of shell rich occupation debris again with non-occupation interbeds. This is the thickest member in the sequence at about 10 m. This member was sampled in a series of small excavations off the initial cutting in cave 1A and off the side of the remaining *in situ* deposits in cave 1. For convenience these excavations have all been referred to cave 1A. The squares K48, J48, L51, M50, O50, T51 and T50, layers SM1-BS4L (Table 11 , 1; Fig 39 Appendix 1) have provided a sample of artefacts that has been designated MSA ll upper.

A thick shell bed, SM5 (Fig. 5), exposed in the base of square T50 was taken as the stratigraphic marker for the top of the lower set of strata in the SAS member. The lower strata were sampled mainly in squares AA43 and Z44 and the interface between the SAS and LBS members was placed in unit SCB2 in these squares (Table 11, Appendix 1; Fig 39, Appendix 1). The artefact sample MSA ll lower in the analysis comes from these strata.

The unit SM5 in T50 can be traced above the section exposed in square AA43 (Fig. 5) and appears to correlate with Layer 16 as mapped by Singer & Wymer (1982 fig. 3.2). Establishing this correlation is important because it allows the 1984- excavation in the witness baulk deposits (Fig. 8) to be related to the sequence in cave 1A. The witness baulk excavation was designed to establish the association of finds of human remains in cave 1. It has been hypothesised (Deacon, H.J. 1995) that all the human remains recovered in the SW-sample from cave 1, come from the same horizon and represent a single episode of accumulation. The witness baulk excavation has provided a large artefact sample that is included in this analysis. This sample has added to the human remains, with hand and foot bones and teeth, as predicted from SASU or Layer 16.

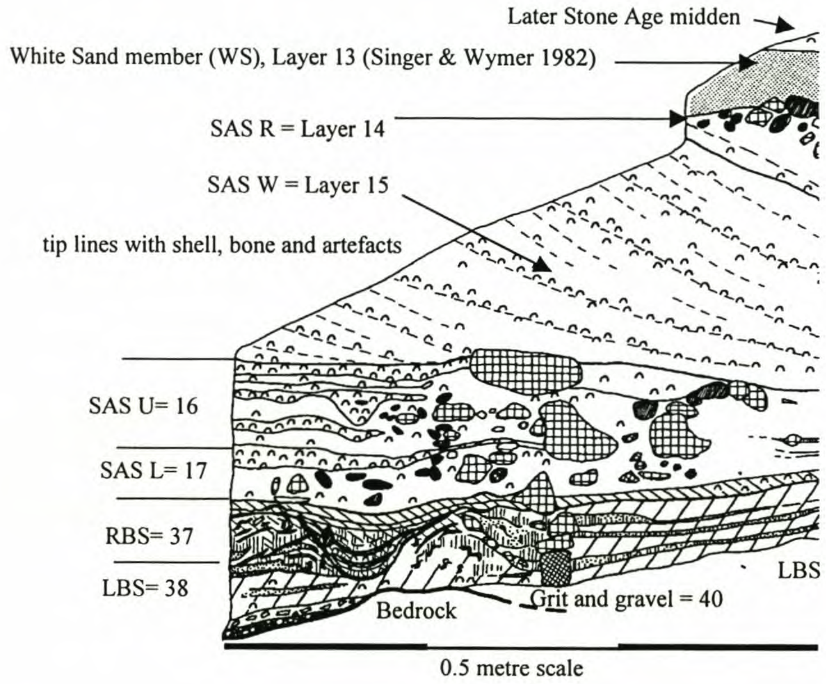


Figure 8. Klasies River main site, cave 1 witness baulk, east face entrance area.

From the diagrammatic sections that have been published (Singer & Wymer 1982: figs. 3.2-3.5), it was not possible to identify the precise boundaries of the layers excavated in 1967/8. Thus the sub-members of the SAS member have been defined as the approximate equivalents. The witness baulk excavation intersected a small area of the SASR (Layer 14) (Fig. 8). A more significant sample of artefacts was obtained from the SASW (Layer 15). These deposits dip steeply into cave 1. Tip lines show they are slope deposits formed as sediments accumulated in cave 1A. Although the artefacts are not in primary archaeological contexts, they can be related to the MSA ll upper artefact sample, coming as they do from the strata overlying the stratigraphic marker, the SM5 unit.

The SASU sub-member is the lowest horizon that has been sampled in the witness baulk excavation and this would include facies of SM5 exposed in T50. The artefacts from the SASU and the units above SCB2 in AA43 and adjacent squares are grouped in the MSA 11 lower sample (Table 11, Appendix 1; Figure 39, Appendix1).

Other materials for the analysis come from the excavations in cave 1B. The excavations there had two purposes. One purpose was to establish the context and dating of the human mandible, 41815, recovered by Singer & Wymer (1982:141), by correlating the cave 1B stratigraphy with that in cave 1 (Deacon & Schuurman 1992). The other purpose was to investigate the spatial distribution of artefacts and fauna associated with carbonised partings and hearths (Henderson 1990). The sequence in cave 1B (Fig. 9) is more condensed than in caves 1 and 1A and the artefacts in the SAS DC sub-member (Table 11, Appendix 1; Figure 39, Appendix 1) relate to the MSA ll. Singer & Wymer included all the material from cave 1B in the MSA l, but this analysis has confirmed the contention of Thackeray (1989) that the material in the upper part of the cave 1B sequence belongs to the MSA ll sub-stage.

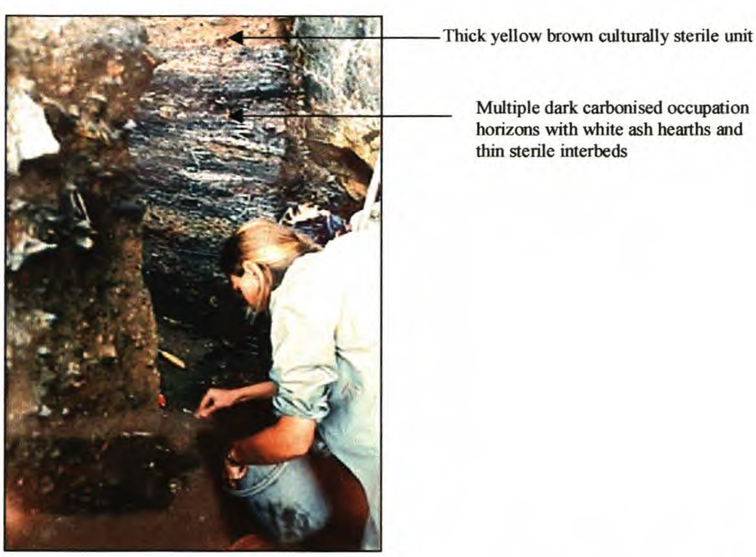


Figure 9. Section through cave 1B showing the multiple carbonised horizons associated with the MSA ll. The lower part being excavated is associated with the MSA l.

RBS & LBS members (MSA 1)

Underlying the SAS member in cave 1, is the RBS member (Layer 37) which is exposed in the witness baulk (Fig. 8) and in the trench section. It is a dark carbonised layer in cave 1 that shows plastic flow and the contorted base is interfolded with the underlying sediments. There have been no excavations in the RBS member since 1967/8. Singer & Wymer (1982) included the artefacts from this member in their MSA 1 assemblage and re-analysis in this study supports that inclusion.

The basal stratigraphic division is the LBS member (Layer 38). These are leached sands with shell lenses and hearths. It has been sampled in cave 1/1A in AA43 and adjacent squares and in cave 1B (RS sub-member) (Table 11, Appendix 1; Figure 39, Appendix 1). The artefacts from these locations have been supplemented by those in the SW-sample from area a in cave 1 (Singer & Wymer 1982: fig. 3.2). The latter materials are from layers 37 and 38.

Although main site is a single depository, subsequent erosion of the original deposits has dissected the accumulated sediments leaving isolated remnants and distal facies preserved in some parts. The depositional history has been studied in detail (Deacon & Geleijnse 1988) and this gives confidence in relating the artefact samples to the stratigraphic sequence. Inevitably, some parts of the sequence are better sampled than others for their artefact content. This is in spite of the extended period of research. Research carried out since 1967/8 has provided a firmer chronology for the artefact occurrences, as discussed in the next section.

Dating

The 1967/8 investigation established a minimum and maximum age range for the deposits. Since the 1980s, there have been advances in dating methods that are alternatives to radiocarbon and that can be used to date materials older than 40 000 years, the limit for radiocarbon. The alternative methods do not have the precision of radiocarbon and there are large uncertainties associated with such estimates. However, main site is one of the best-dated Late Pleistocene sequences anywhere as a result of intensive and ongoing research. This is because the age estimates are based on a number of independent approaches. In addition to chronometric dating, an isotope stratigraphy (Martinson *et al.* 1987) and biostratigraphic data are available as a check on age estimates.

The basal age of the sequence is well established through isotopic studies (Deacon, H.J. *et al.* 1988). The LBS member associated with the MSA 1 artefact sub-stage is dated to MIS 5e/5d. This age estimate is supported by a uranium disequilibrium date of 110 000 years (Vogel *in press.*) and the associated large mammal fauna (Klein 1976) is consistent with a regressional phase. It would seem that the cave was first occupied after sea levels fell from the high in the last interglacial. The basal sediments of the LBS member are coarse sands from a near beach source (Deacon & Geleijnse 1988).

The SAS member appears to have accumulated during MIS 5c (Deacon *et al.* 1988). This is consistent with the large mammal biostratigraphy (Klein 1976) in that habitats appear to have favoured browsers over grazers as would be expected during a transgression. Uranium disequilibrium dating suggests an age of 100 000 years (Vogel *in press*) and ESR estimates (Grün *et al.* 1990) at 93 000 years are somewhat younger. ESR dating tends to underestimate the true age (Vogel *in press.)* and is a method that is affected by a number of site specific variables. For this reason less weight is given to the ESR results. The SAS member is a thick parcel of sediments, which suggests it may have accumulated over a long period. Vogel (*in press)* has obtained a uranium series age estimate which suggests accumulation continued until after 77 000 years. This is in conflict with other dating evidence, which gives older estimates for the overlying members (Deacon H.J. *et al.* 1988).

The RF member has been correlated with MIS 5b (Deacon, H.J. *et al.* 1988) and, as noted, the interpretation of stylistic artefacts trends suggests the RF member represents a significantly long period of low intensity occupation. This would place the occupation associated with the Howiesons Poort in the overlying Upper member in MIS 5a/4. A dating centred on 70 000 years (Deacon 1989, 1992) has been argued for the Howiesons Poort layers. This is older than the 65 000 year estimate on uranium series dating obtained by Vogel (*in press*), but it is in accord with amino acid dating estimates obtained for the Howiesons Poort horizon elsewhere (Miller *et al.* 1992; Miller *et al.* 1999).

Despite considerable progress in dating the Late Pleistocene deposits at main site, there remains a need for more precision. However, the age range of the artefacts is reasonably established. Whether it is accepted that the Howiesons Poort horizon dates to as young as 65 000 years, or is older than 70 000 years, does not affect the argument offered in this dissertation. The Howiesons Poort and other culture-stratigraphic divisions recognised here long predate the supposed beginnings of modern symbolic behaviour in the Upper Palaeolithic (Mellars 1998).

Interpretation

The re-investigation of the Klasies River site has involved not only refining details of the stratigraphy, dating and the context of the materials, but also the development of a theoretically informed interpretation of the evidence. Although the human remains have been interpreted as anatomically modern (Stringer & Andrews 1988; Rightmire & Deacon 1991; Bräuer *et al.* 1992; Rightmire 1998 but see Caspari & Wolpoff 1990; Wolpoff & Caspari 1990; Wolpoff 1992; Frayer *et al.* 1993), the perception, mainly from the fauna (Klein 1976), has been that the people were not modern in behaviour. Much of the development in theory has been directed at dissecting this apparent conundrum of people being modern in body and not in mind.

The succession of carbonised partings, hearths and shell middens at main site represent the same kind of occupation debris that accumulates in Later Stone Age coastal sites. This suggests that despite differences in artefact details, Middle Stone Age communities lived in the same way as hunter-gatherers in the Later Stone Age and in the ethnographic present (Deacon, H.J. 1988). The question then becomes how different was human behaviour in the Middle and Later Stone Ages. Site formation processes suggested similarities were more significant than the differences. To suggest that early modern people living at the Klasies River sites were modern in their behaviour and the possible ancestors of the San (Deacon, H.J. 1992) flies in the face of accepted wisdom. This contention would make modern ethnography directly relevant to the interpretation of the

Middle Stone Age. It is this thinking, developed by H.J. Deacon, that has shaped the approach to research at the Klasies River sites.

The evidence from main site has become the centre of a debate, between R.G. Klein and H.J. Deacon, that has much wider relevance. As discussed in Chapter 7, Klein is a strong advocate of the 'late modern behaviour' (LMB) hypothesis, while Deacon is a proponent of the 'early modern behaviour' (EMB) hypothesis. The debate is properly about the archaeological markers that can be used to identify modern behaviour and it is this question that gives the debate wider relevance. The identification of such markers is a prime concern of this dissertation.

The markers proposed by researchers who hold with the LMB hypothesis have been constructed within the context of the apparent differences in behaviour between Neanderthals and Cro-Magnons in Europe. These differences are in artefact typologies, in the kinds of materials used for making artefacts and in 'artistic' expression. H.J. Deacon has argued that there is no equivalent discontinuity, with replacement of one population by another, in regions like South Africa. He has proposed that the search should be for universals or higher level generalisations, rather than context specific behavioural markers. A major contribution has been in pointing out that economic imperatives, like optimising the exploitation of available food resources, are not relevant to debates about the evolution of modern behaviour (Deacon, H.J. 1989).

Other contributions have been in extending the concept of artistic expression to include the use of ochre as a colour-coded symbol and to see artefacts as media for reciprocal exchanges. By ethnographic analogy, the occurrence of small circular 'individual' hearths in Middle and Later Stone Age contexts, have been interpreted as an archaeological signal of the reproductive woman (Deacon, H.J. 1995). In using analogy to interpret such features and to explore large-scale patterning like the geographical correspondence between Howiesons Poort occurrences and San languages (Deacon, H.J. 1992), the explanatory power of this approach is shown. A recent example is an attempt to explain the basis of modern versus non-modern behaviour by linking the distribution of Middle and Later Stone Age sites to the movement of modern hunter-gatherers in the landscape

(Deacon, H.J. 1998). Middle Stone Age people, like their Later Stone Age and ethnographic counterparts, are characterised as eurytopic. This behaviour is contrasted with that of Acheulian groups who were stenotopic and restricted to occupying wetlands and valleys. The conjecture is that Acheulian groups were not hunter-gatherers in the ethnographic sense and that they lacked the modern social mechanisms to aggregate and disperse as do all extant hunter-gatherers.

It is ideas like these that have brought a new dimension to what has become a somewhat stale, eurocentric view of the emergence of modern behaviour. This dissertation is designed to extend this kind of reasoning and investigate how the study of artefacts can provide evidence for symbolic communication. Symbolic communication is a universal, a trait common to all modern people, and it is the product of the modern mind. The next chapter discusses how symbolic communication may be recognised in the archaeological record.

CHAPTER THREE

SYMBOLIC COMMUNICATION AND STONE ARTEFACTS

Introduction

There is general agreement that symbolic behaviour is the hallmark of the modern mind (Gould 1980; Donald 1991, 1993; Stringer & Gamble 1993; Byers 1994, 1999; Noble & Davidson 1996; Mithen 1996; Deacon, T.W. 1997a,b). In the last century the fathers of evolution like Haeckel, Huxley and Darwin emphasised the chasm between human and animal communication. What sets humans apart from other species is the habitual use of symbols in speech to communicate (Deacon, T.W. 1997a). The ability to conceptualise symbolically is the distinguishing trait of human communication. Speech is a support for symbolic communication and may be seen as a consequence rather than the cause of the evolution of symbolic language (Deacon, T.W. 1997a:255). Modern behaviour can be defined as the ability to use a symbolic memory strategy. To make this definition operative it is necessary to show that the evidence from stone artefacts can be related to symbolic communication. This is the purpose of this chapter. There are theoretical developments that place inferences on human symbolic communication drawn from archaeological materials on a sounder basis than hitherto.

A definition of symbolic communication

The nature of symbols and symbolism has been the subject of extensive literature in the fields of linguistics, psychology and philosophy. The starting point in any discussion of symbolic evolution is the semiotic theories developed by De Saussure and Peirce (Sinha 1996). The French linguist, Ferdinand de Saussure (1857-1913) proposed that language is a system of signs, and he called it the science of signs, or semiology. In the system of signs there is a signifier (word) and a signified (that to which words refer), and there is no natural relationship between the signifier and the signified.

Particularly influential in archaeological usage of semiotic theory has been the recognition by the American philosopher, C.S. Peirce (1839-1914), of three hierarchical related forms of referential relationships. The three categories of signs in order of increasing complexity are icons, indexes and symbols. Icons, at the lowest level of the interpretative hierarchy like photographs, realistically resemble what they represent. An index is correlated to something else in time and space. Thus a thermometer indicates the temperature of water, or a vervet alarm call indicates the presence of a leopard. The highest level of complexity is represented by symbols. In a symbol, the only link between a signifier and signified is a social convention or an arbitrary code understood by a group of people. The use of body paint is symbolic because the meaning depends on social convention.

The use of symbols in communication is more than just a manifestation of behaviour. It is supported by the specialised architecture of the brain. Symbolic communication is the outward expression of a specific kind of representational mode of thought. Representation is achieved by neuronal actions that allow a sign and its referent to be associated and interpreted (Bickerton 1990; Donald 1991; Deacon, T.W. 1988, 1997a,b). The hierarchical scheme of Peirce can be related to different kinds of representation (Deacon, T.W. 1997a). Recognition allows iconic reference and that is the basic level at which things can be represented. Indexes are recognised through the interpretive process of association. The representation of both icons and indexes is produced by perceptual and learned responses. These responses are produced as if the signified was present. What is involved is a fairly simple memory or mnemonic strategy.

Symbolic representation is radically different from iconic and indexical representation. It marks a shift from associative to symbolic predictions. The signs have to be coded in another way – they need to be re- represented. This change in mnemonic strategy involves discovering a system, or higher order regularities. 'Unlearning' of associations has to take place to make the construction of rules about classes of combinations possible. Things become represented within a distributed web of reference. In the web, the relationship that a referent has to an object, is also a function of the relationship it has to other symbols (Edelman 1987; Deacon, T.W. 1997a). For example, the word cat is simultaneously associated with dog, animal, meow and words that rhyme with cat. It is via unlearning that the bonobo chimpanzee, Kanzi, and common chimpanzees, Austin and Sherman, were taught to communicate with symbols. It took thousands of trials to teach them to shift attention from token-object relations (indexical) to token-token (symbolic) relations by unlearning the concrete association in favor of a more abstract one (Savage-Rumbaugh 1986; Savage-Rumbaugh & Lewin 1994).

Humans have little difficulty with these kinds of tasks. As discussed in Chapter 7, their disproportionately large prefrontal cortex provides the neural maps necessary to support a distributed web of reference (Deacon, T.W. 1997a). Not only are human brains organised to accommodate a symbolic memory strategy, but symbolic communication structures the lives of all modern people. Mundane and non-mundane things and events derive their meaning from a "symbolic web" (Wood 1992; Byers 1994; Deacon T.W. 1997a) or a 'virtual reality'.

The link between symbolic communication and stone artefacts

The role of the symbolic web in a society is obvious where material culture items, like depictions and personal ornaments, are the concern. Yet the symbolic web encompasses all facets of living. It follows that symbolism is manifest even in mundane forms of material culture. This dissertation is about the commonest archaeological remains, stone artefacts and, in particular, those of the Middle Stone Age. The interest is in the ways symbolic communication may be inferred from them. The presence of discrete formal categories or types has long been regarded as one, if not the main, indicator of symbolism in stone tools.

Types, standardisation and symbolic behaviour

There are various reasons given for accepting that standardised types of stone artefacts can be used to infer symbolic behaviour. Mellars, long an advocate of the link between types and symbolism, argues that "…standardization and imposed form goes far beyond the purely functional or utilitarian requirements of the tools, and must necessarily imply some symbolic *concept* of the individual tool forms, which in turn was reflected, either consciously or unconsciously, in their specific shapes and visual appearance" (Mellars 1996a:25, italics original). The important point is that form has been imposed on stone artefacts for more than utilitarian reasons. The imposition of form is thus arbitrary, in the way that symbols are arbitrary to their referents in language. Symbolic communication can be posited where such arbitrary forms can be showed to have been a convention. This requires that a form or motif is repeated often enough to indicate it would have some shared meaning (Chase 1991:200). Noble & Davidson (1996) and Davidson (1997) regard the standardisation of a type as symbolic because it demonstrates conscious planning and forethought with the intent to make an artefact. This kind of planning involves arbitrary conventionality, which is not possible without using symbolic language. Byers (1994, 1999) stresses the semiotic role of artefacts in culture. In modern societies organised by language, artefacts are invested with style through the overdetermination of form. The overdetermination is arbitrary and not related to function. When overdeterminations change in a volatile fashion through time, symbolic behaviour is indicated.

Chase (1991) has reservations about regarding types as evidence of symbolism. He contends that types do not represent the cognitive categories associated with linguistic categories or syntax. This is because the way in which a word has an arbitrary relationship to its referent is different from the arbitrary relationship a tool has to its function. But the argument can be made that there is a multitude of artefact designs that can fulfill the same purpose. When one of these is arbitrarily chosen, the relationship between function and form is arbitrary in the linguistic sense. Another caveat of Chase is that standardisation cannot be regarded as an indicator of symbolic behaviour if it can be linked to function or technology. Standardisation may be imposed by hafting, or by strengthening of the working edge of an artefact. However, it is impossible to separate function and the imposition of form, and in the example of a retouched point, both may be implicated.

Dibble (1987, 1989, 1991) has argued that some types, for example scraper types, are the product of re-sharpening rather than the imposition of form through a mental template. Although many of the shapes recognised relate to different stages in the life history of an artefact, re-sharpening does not explain all variability. Re-sharpening is clearly not involved where there is flat invasive retouch to create points, or backing retouch to impose form. This counter-argument can be extended to the shaping of a point by prepared core technology. The preparation of a core to produce a product, which has a preconceived form, is as much imposition of form as shaping by retouch. Imposition of form involves the concept of prototypicality.

Making and classifying things into discrete categories is typical of the way in which humans think. All people across all cultures categorise the world in similar ways (Atran 1990; Berlin 1992). Classification takes place around a prototype (Rosch 1973, 1978; Rosch & Mervis 1996). This ability may be innate or learnt. For instance, some categories probably have a physiological basis, as in the recognition of colours, forms and facial expressions (Rosch & Mervis 1996; Deacon, T.W. 1997a). The colour red, the colour of blood, for example, is universally the first colour recognised and named. Categorisation is allowed by symbolic representation, an ability unique to humans. The types recognised by archaeologists are etic not emic categories; they are recognised from outside the cultural system that produced them. The meaning those types had for the artificers is unknowable. This is a drawback to the study of archaeologically defined types. The way around this limitation is to focus not on the categories *per se*, but on changes in the categories in time. Stronger inferences about symbolic communication can be made if the dynamic nature of human symbolic culture is taken into account. The discussion of style and symbolic communication below shows how this dynamic dimension can be included in the argument.

Types, style and symbolic communication

In the formative years of archaeology, types of artefacts made in the same style were considered to represent the culture of an ethnic group. In reductionist terms, artefacts were regarded as ethnic groups and it was possible to write about the 'Wilton people' or the 'Still Bay folk'. In the late 1970s, a seminal paper published by Wobst (1977) initiated a shift in understanding of style. He argued that style has a function, that of social communication. Those aspects of artefact form and structure that can be related to processes of information exchange can be regarded as stylistic.

Many of the writings on style follow this dictum and regard style as symbolic if the conscious intention of the artificer has been to send a message by stylistic design (Chase 1991; Sackett 1982, 1990; Plog 1995; Duff *et al.* 1992; Wiessner 1983, 1990; Conkey 1978; Hodder 1982). This is active style. By contrast artefacts that were the product of conventional ways of doing things and were not intended to carry messages, are not symbolic and carry isochrestic or passive style (Sackett 1977, 1986).

Byers (1994:377) argues that the distinction between active style as intended and passive or isochrestic style as unintended, is false. The symbolic aspect of style lies in the tradition, or rules that govern form, consciously or unconsciously. "Style is produced not to communicate information about one's social and personal identity, but to constitute that identity" (Byers 1994:378). The important implication is that artefacts not only carry style but are style. This point is taken up later in the discussion.

A different perspective in the study of style is offered by Dunnell (1978) who has developed an explicitly Darwinian framework. Selectionists or evolutionary archaeologists such as Dunnell (1996), O'Brien & Holland (1992) and Neiman (1995) see stylistic traits as non-functional or neutral. Therefore, stylistic traits are not under natural selection and do not affect fitness. In contrast, functional traits contribute to reproductive success. The non-adaptive nature of style causes it to 'drift' and stylistic drift would be detectable in random changes through time. Such changes are best demonstrated in the well known 'battleship curves' of artefact frequency seriation.

This approach may be less useful for the study of style for two reasons. According to evolutionists style and function can be separated, but style and function are enmeshed and their separation is not attainable even in the material culture of present day societies. Artefacts are not intended to be either functional or stylistic. The evolutionist approach has also been criticised for regarding artefacts as the unit of natural selection (Boone & Smith 1998; Preucel 1999). Artefacts are treated as if they are directly subject to natural selection (O'Brien & Holland 1992) because they are part of the 'extended phenotype' described by Dawkins (1976). Changes in artefact frequencies through time are considered as the result of selection acting on phenotypic variation. However, in biological and cultural evolution, phenotypic variation does not itself constitute evolutionary change. Something that is the direct subject of natural selection, a replicator, needs to be identified (Boone & Smith 1998:143). Artefacts cannot be both the vehicle for evolution and the replicator (Bateman *et al.* 1990). Selection can act on phenotypic variation only to the extent that it is heritable, and correlated with replicators transmitted from parent to offspring. In the evolutionary approach, this correlation is assumed or asserted but it is not explained (Boone & Smith 1998:144). Even if artefacts themselves are treated as the units of heritable variation (replicator), they still have to fulfil the criterion of invariance over a long period before natural selection can act on them. For this reason it cannot be argued that natural selection acted on, for instance, the imposition of form as recognised in the Howiesons Poort, and developed into the fully modern symbolic abilities evident in the Later Stone Age or Upper Palaeolithic.

The approach of Byers (1994, 1999), which emphasises the dynamic nature of style, merits further discussion. He came to the conclusion that artefacts are style in developing an action-constitutive theory of material culture usage. Artefacts are linked to symbolic language because, by imposing normative style on material culture, material action is constituted. This action is dependent on the same cognitive capacities as symbolic language. Symbolic language takes over all aspects of human society to the extent that the symbolic web determines conventions and meanings independent of functions. The idea of warranting is central in Byers' proposition. In modern populations, all material culture like tools, decorative artefacts, clothing, furniture and the like, are warranted or sanctioned in order to have meaning within a social context. Warranting is achieved by the exercise of arbitrary rules or conventions about the form of artefacts, regardless of the function they may fulfil. Byers terms this, overdetermination of form. As social rules change, material culture changes in a volatile fashion. It is this volatile change of styles that patterns the archaeological record.

Byers (1994, 1999) recognises three kinds of style:

Style 0 artefact assemblages will display insufficient variation on which to postulate practical (functional) traditions and their production-learning contexts. These kinds of artefacts had no intentional communicative role. An example would be Oldowan artefacts.

Style 1 artefact assemblages are described as "stabilised isochrestic variation" and this implies that the form of an artefact does not change over time. A communicative and utilitarian role, but without a symbolic warranting capacity, is inferred. This is not a modern expression of style because form does not change in a volatile fashion. This kind of style is exemplified in the variation in Acheulian handaxes.

Style 2 artefact assemblages have the characteristic that function underdetermines form. Normative (arbitrary) rules narrow the range of possible tool forms for a specific task, and select what is used. The artefact forms chosen become established or legitimised as a result of normative socialisation by which each generation learns the symbolic as well as the practical know-how in order to warrant their material behaviours. This kind of style would be exemplified in the Upper Palaeolithic and all modern societies.

Byers has developed his action-constitutive theory to explain the Middle-Upper Palaeolithic transition in south-western Europe. The transition is described as a rupture, a shift from the Middle Palaeolithic style 1 assemblages to the Upper Palaeolithic style 2 assemblages. He (1999:31) concedes that there may have been other transitions or ruptures not currently perceived or agreed upon by archaeologists. This is a tacit admission that claims for early modern behaviour in Africa, long before the advent of the Upper Palaeolithic, may have substance. The theory is essentially eurocentric. Its strength lies in defining modern or style 2 behaviour in terms of a symbolic web and in the concepts of warranting and overdetermination.

How style 2 can be recognised is developed further in this dissertation. The notion of form or type can be extended to include 'ways of doing things', that is technology. Different ways of making artefacts in a temporal sequence are as strong an indicator of symbolic abilities as overdetermination of form in types. A fundamental difference between style 1 and style 2 is the volatility or the rate of stylistic change. As Upper

Palaeolithic types change in rapid succession (Mellars 1991, Mellars 1998) and Upper Palaeolithic communities were behaviourally modern, it is assumed that stylistic volatility is a condition for recognising symbolic behaviour. The rate of stylistic change in the Upper Palaeolithic may not be a good yardstick. This is because the rate may be somewhat inflated. The spread of the Upper Palaeolithic coincided with a period of significant population growth (Harpending and Relethford 1997). It can be assumed that the speed of technological change is a product of the rate of the appearance of innovations, and at least in part, this would be a function of population size.

Conclusion

The nature of archaeological data necessitates the use of typologies. Conventionally, the presence of standardised artefact types made to a mental template, has been the basis for recognising symbolic communication. A further indicator would be typological or more properly stylistic variation *sensu* Byers. This is because fluctuation in conventions is an indication that material culture has become part of the social realm, the mark of modern societies. By including 'ways of doing things' or technology as part of stylistic variation, the methodology by which symbolic behaviour can be studied is expanded. In the next chapter typological and technological approaches to the analysis of stone artefacts, and in particular the stone artefacts of the Middle Stone Age at Klasies River main site, are discussed.

CHAPTER FOUR

CONCEPTS IN THE STUDY OF TECHNOLOGY AND ARTEFACTS

Introduction

William Holden Bowker who 150 years ago first recognised stone artefacts as occurring in South Africa (Hewitt 1955), did so because the ones he found, looked to him like spear points. He was a military man on a colonial frontier and had faced spears although not stone tipped ones. He offered a functional typological explanation for the some 40 artefacts he collected in the Eastern Cape. They are Middle Stone Age flakes and points. Functional classifications were the conceptual basis of the initial attempts at studying artefacts. Some names for artefacts such as scrapers, borers and burins are still in use. Again in the beginning of the last century, as more comprehensive classifications were developed, the emphasis shifted from function to form. Function was uncertain, if not unknowable, but shape or form was directly observable. Repeated forms could be recognised as types. The study of types, typology, was a methodology that archaeologists could use to investigate patterns in time and space in the artefacts made by extinct communities. In South Africa, Bowker initiated the process of the discovery of types through his classifications. His contemporaries found stone artefacts to be widespread and abundant in the landscape and they developed typological schemes to order what were predominately surface finds.

Some typologies were locally developed and others borrowed, almost exclusively from the main centre of lithic studies, France. The borrowing was via Britain rather than direct. Latterly, the borrowings have continued, but specifically since the 1960s the concepts have been borrowed via North America. Typologies have been refined in two ways. Firstly, through simply counting. Lists of types were supplanted by frequencies of types or classes. Secondly, metrical attributes were used to define types more precisely. What was a small or a large scraper could be given some value. The quantitative revolution, promised with the advent of the computer, did not materialise and the discovery of types is achieved more efficiently by the inborn abilities of the typologist than the best programmed machine. The concept of artefact type and the use of typology in the study of artefact assemblages is still a primary approach.

The emphasis on form rather than function has meant that studies of technology have been somewhat neglected. Techniques of making artefacts have been inferred from typologies at a very general, matter of fact level, rather than through replication or the detailed analysis of the by-products of successive stages in manufacture. A distinction can be made between industries where the types are made on retouched flake fragments and industries where the types are given a predetermined form through core preparation. An example of the former would be the Holocene Wilton industry. The investment of effort is not in techniques to produce flake blanks but in retouching the piece to obtain a standardised form, usually to insert in a haft as a composite tool. In the latter industries, which would include the Later Stone Age, Robberg industry, and the industries of the Middle Stone Age, the primary investment is in preparing the core to produce blanks that have a ready to use form, without the need for shaping by retouch. While a mainly typological approach may be acceptable to study a Wilton industry, a different methodology is necessary in the study of Middle Stone Age industries. This methodology depends on the investigation of the artefact production sequence or technology and, in particular, of the preparation of the core. This explains the importance given to the discussion of core technology in this chapter.

Prepared core technology and Goodwin's dilemma

In the early 1900s in Europe, the scheme of epochs formulated by de Mortillet for the French Palaeolithic was extended by scholars such as Breuil and Burkitt (Daniel 1950). In contrast to the Lower Palaeolithic, Chellean and Acheulian, the Middle Palaeolithic Mousterian was defined by de Mortillet as characterised by tools chipped entirely on flakes and by the absence of worked bone. What Breuil contributed was the idea that the technique used to strike off typical Mousterian flakes was the Levallois technique (Rolland 1995:334). Named for a suburb of Paris, the concept of the Levallois was changed from that of a culture to a technique of preparing cores to determine the form of the flake blank produced. The Levallois technique of core preparation, together with the absence of worked bone, became ways in which the Middle Palaeolithic could be distinguished from the Upper Palaeolithic. The Neanderthals made the Middle Palaeolithic artefacts and modern humans made the Upper Palaeolithic tools, so distinguishing between the two stages was important. Although Bordes (1961) was later to redefine the relationship between the Levallois technique and Mousterian typology, in the conventional view of European archaeology, the Levallois technique retained a strong association with non-modern humans. By extension, it is assumed that people everywhere who used a Levallois-related prepared core technology, like the Neanderthals, were not modern in their behaviour. This would include Middle Stone Age peoples in sub-Saharan Africa.

Goodwin (1958:29) considered that the early researchers, like Dunn, Stow and Peringuey, saw the Stone Age sequence in South Africa through 'European spectacles'. Throughout his career he remained sceptical about the parallels drawn between artefact industries separated by the length of a continent. This scepticism was expressed in his formulation of the scheme of Earlier, Middle and Later Stone Ages, set out in his joint publication with Van Riet Lowe (Goodwin & Van Riet Lowe 1929). In this publication, the Middle Stone Age was defined as including variations and industries. Characteristic were flake artefacts with faceted butts, more frequently showing convergent rather than parallel scars on the dorsal surface. The dilemma that Goodwin faced was in explaining how the Middle Stone Age was different from the Middle Palaeolithic Mousterian when both shared what he termed a prepared core technology and what European researchers termed a Levallois technology. Goodwin (Goodwin & Van Riet Lowe 1929; Goodwin 1933) described the prepared cores in the Victoria West and Fauresmith industries as 'proto-Levallois' (Van Riet Lowe 1945). This implied that the Middle Stone Age technology developed out of the Acheulian, a continuity that was not then and is not now demonstrable in the European sequence. In the intellectual climate of the time, Goodwin was forced to assume that the industries in Europe were much older than those in remote South Africa to explain how the Earlier Stone Age could show Mousterian influences. The Middle Palaeolithic Mousterian had to be much older than the Middle Stone Age. The answer to Goodwin's dilemma is to accept that the Middle Stone Age is a technological stage, synonymous with the Middle Palaeolithic and a stage that is more ancient in Africa than in Eurasia. The possibility, that prepared core technology was independently invented in two continents is remote, especially when an older Acheulian biface technology was shared. Africa was the centre and Eurasia the periphery through much of prehistoric time, not *vice versa* as Goodwin thought.

In a post-Goodwin era, the perspective of researchers has become more parochial. J.D. Clark (1959) in his influential book on the prehistory of southern Africa, stressed autochthonous developments over the diffusion of influences. Mason (1962) undertook the first modern regional study and, in his *Prehistory of the Transvaal,* he also moved away from diffusionist ideas. The recommendations of the Burg-Wartenstein Conference (Bishop & Clark 1967) encouraged an inductive and rigorously typological approach to prehistory, building a hierarchy of stone artefact occurrences, industries and complexes. This approach is best exemplified in the synthesis of Sampson (1974) which introduced a plethora of new regional names for industries and complexes and eschewed the term Middle Stone Age. Subsequent researchers have been reluctant to follow Sampson in defining regional variants and intersite correlations have not been emphasised. This is perhaps because, in the absence of adequate chronometric dating, the synthesis of Sampson was premature. Other researchers consider intersite variability to be idiosyncratic (Volman 1984:201; Thackeray 1992:398). However, influences of the Burg-Wartenstein recommendations can be seen in the almost exclusive concern with typologies.

It is the contention of this dissertation that where the study is of assemblages made by Levallois-type prepared cores that produce preformed blanks, an understanding of the technology is essential not only to construct meaningful typologies but also to make any higher level inferences about intersite correlations and 'cultural traditions'.

Advances in the study of technology

The main thrust in the development of technological studies has occurred since the 1980s. In studies of the Middle Palaeolithic, it has had a "dramatic and controversial impact on archaeological systematics" (Chazan 1997:720). The advances have been in studying the whole reduction sequence, and not only the end products. The French sociologist and ethnologist, Marcel Mauss (1872-1950), had anticipated the importance of technical actions. Another French archaeologist, ethnographer and philosopher, André Leroi-Gourhan (1911-1986) gave explicit meaning to such studies in coining the term *chaîne opératoire*. The study of reduction sequences had became important with the processual thinking of New Archaeology in the 1960s in America (Bar-Yosef & Dibble 1995:x). This is exemplified in the work of Collins and Bradley (Villa 1991). It took a decade or more for technological studies to become widely accepted.

The goal of technological studies is to understand the processes of making and using artefacts, from the initial stage of raw material acquisition to the final stage of the discard of the used artefacts. The approach has been formally termed the *chaîne opératoire,* or the chain of operations. It is more holistic than the study of reduction sequences. The *chaîne opératoire* refers to the unfolding of the technical act (Chazan 1997). Method and technique are the key concepts. Method refers to the conceptual model that guides the technical act. It involves procedural know-how or skill (*savoir faire*) and abstract knowledge or understanding (*connaissances*). Technique refers to the way energy or force is transmitted to produce an artefact (Knuttson 1988; Chazan 1997).

The concept of Levallois is central to technological studies in the Middle Palaeolithic. Since the recognition of the Levallois as a technique and not a culture or industry, there have been many attempts at its definition. A recent symposium (Dibble & Bar-Yosef 1995) showed that among researchers, there is still a lack of consensus and precision in the definition of Levallois. This suggests there may be not one but many core reduction strategies that resort under the label 'Levallois'. The most extreme view, that of Dibble (1989), is that the term Levallois has no value and that it is just a specific method of core reduction that leads to many end-products. The most important recent advances in understanding what constitutes the Levallois technique have been a change in emphasis from studying the morphology of the cores and flakes to studying core reduction in terms of volumes (Boëda 1995). What is important is the 'setting up' of the core as a mass of material in a particular way to allow the removal of preformed flakes. It is in this sense that the concept of the Levallois has meaning for not only the Middle Palaeolithic but its African equivalent, the Middle Stone Age.

The following are the characteristics that identify a Levallois strategy. These are those proposed by the French researchers Boëda, Pelegrin, Geneste, Meignen amongst others (Chazan 1997) and by the Belgian researcher, Van Peer (1992, 1995).

Six criteria should be met:

a) The core consists of two volumes, opposed to each other, and which intersect horizontally.

b) The two surfaces are hierarchically related. One is passive and the other is active. The passive surface is called the undersurface (Van Peer) or the platform surface (Chazan) and is usually more convex than the active face. The active surface is termed the upper surface (Van Peer) or production face (Chazan).

c) An important feature of the Levallois technique is that the active or upper surface is organised in such a way that the morphology of the products is predetermined. This is achieved by controlling of lateral and distal convexities. The active surface is given a dome shape.

d) The passive face, (striking platform or under surface) is organised to allow the removal of predetermined flakes from the production surface and this requires that the intersection of the striking platform surface and the flaking surface must be perpendicular to the flaking axis of predetermined flakes.

e) Van Peer (1992:66) adds that the under surface will have an angle with the intersection plane of about 60 degrees at the proximal or striking platform end, and the opposed or distal platform will have an angle of about 50 degrees. Van Peer (1992:99) considers the absolute values for distal and proximal angles as very characteristic. It can be added that not all cores show opposed platforms and the distal platform which controls the termination of the flake may be absent.

f) The flake products using the Levallois technique are normally detached by direct hard hammer percussion technique. The use of a soft hammer to detach blades from Levallois-type cores is discussed elsewhere.

The divergent views of what is a Levallois strategy arise because there are different ways in which flake products can be struck from the active surface. The classic concept of a Levallois strategy is that the intention is to produce a single or a limited number of end-products. This is the so-called *méthode linéale*. The view of the 'modern Levalloisians' (Van Peer 1992:5) is that a series of Levallois products can be struck from the upper surface of a core before it has to be reconfigured. The scars from previous removals shape the active surface for subsequent removals. This is known as the recurrent method (*méthode récurrente*). The recurrent method can be categorised by the number of platforms used: unidirectional (one platform), bi-directional (two opposed platforms) and centripetal (two or more adjacent platforms). A series of parallel sided and/or pointed flake products can be removed in this manner (Mellars 1996b).

The Levallois technique can be seen as a method for controlling shape and the scars on the upper surface of the core guide the rupture plane of the flake or blank product (Van Peer 1992:39). When a compression force is applied to the surface of hard isotropic rocks, the force spreads through the stone in a compression wave. This results in breakage along a plane tangential to the direction of the applied force. Rupture takes place in a 'S' shape. The contour of the upper surface of the core will determine the direction of the rupture. A convex upper surface is required to control this rupturing. If the convexity is insufficient, rupturing will not be in the core mass and an overpassed flake will be the result.

The position and inclination of the ridges that form the higher areas on the upper core surface are known as the rupture points. The force is guided through these points (Van Peer 1992:37). In particular, it is the longitudinal ridges that determine the distal rupture points. The presence of a longitudinal ridge at the distal end will result in a triangular shape of the distal end. A guiding ridge, not necessarily a central ridge, is an essential feature in a Levallois reduction strategy (Van Peer 1992:41).

There are core reduction techniques in the Middle Palaeolithic that are generally considered to fall outside the definition of the Levallois. These so-called non-Levallois techniques resort under various names, the discoid method, the trifacial method and the blade production method. In each of these methods, the form of the flake products is determined by the different spatial configurations of the core. Although in some sense all cores are prepared, these are prepared cores in the same sense as Levallois cores. This harks back to the quibble of Dibble (1989) that the term Levallois has no value. What then should be made of the prepared cores in the Middle Stone Age and do they show a Levallois reduction strategy? Labels apart, the Middle Stone Age cores meet the criteria that are listed above for a Levallois strategy. It should be noted that the Levallois strategy has not been defined solely on samples from the type-site. Bordes (1961) referred to North African examples in his description of the Levallois technique. The definition of Van Peer (1992) is based almost entirely on North African materials. A researcher from southern Africa may consider examples from North Africa as Middle Stone Age rather than Levallois Mousterian.

A technological approach to the study of the Middle Stone Age

The conventional stages of the *chaîne opératoire* are raw material acquisition, method of blank production, technique of blank production, retouch and/or use and discard. These stages are particularly relevant to the analysis of artefact production in the Middle Stone Age. In the Middle Stone Age, the blanks are standardised preforms and retouch is infrequent. The production of blanks is such an important stage in this chain in the Middle Stone Age that it encourages the primacy of the study of technology over typology. The purpose of the analysis, whether typological or technological remains the same – to learn about behaviour from the analysis of assemblages.

The starting point for a technologically based analysis, is sorting the artefacts into relevant, broad, typological classes. This is to reduce the data represented by large quantities of flaking debris in any assemblage. Small (<10 mm) trimming flakes, broken pieces or chunks and irregular flaking debris are standardly counted in a sample but these pieces carry little information other than that knapping took place on site. Other classes are potentially more informative.

Singer & Wymer (1982) developed a classification for the artefact samples they recovered and the classes they recognised have been used in subsequent studies (Thackeray & Kelly 1988) with minor adaptation.

The following terms used in this dissertation differ from previous typological schemes:

- The term blade sections is preferred to blade segments (Singer & Wymer 1982);
- The term chips is preferred to flaking debris (Thackeray & Kelly 1988);
- The term points is preferred to convergent blades (Thackeray & Kelly 1988);
- Other minor differences in platform description are noted in Table 13 (Appendix 1).

The primary interest of classification adopted here lies in cores in various stages of preparation, the blanks produced from them and any modification of the edges of the blanks. Constructing meaningful categories for such materials depends on an understanding the reduction sequence followed. The sequence has to be inferred from the products themselves. In this the scheme of the *chaîne opératoire* is a guide. The decision steps in the *chaîne opératoire* are discussed below.

Raw material selection

In southern Africa good quality raw materials are widely available. The diversity of materials is generally low. This is an advantage because where there is a choice and selection is exercised, it is very apparent in changing frequencies of one material over another in a sequence. Raw material selection is a feature of the Middle and Later Stone Ages assemblages and may show strong patterning through time that is area, rather than site specific. As argued elsewhere, this suggests raw material choice is an expression of style and not necessitated by function.

Raw materials categories recorded following Singer &Wymer (1982) in the Klasies River environment are:

a) local raw material, materials available in the immediate vicinity of the site: quartzite

b) non-local raw material, materials not available in the immediate vicinity of the site: silcrete, milky quartz, glassy quartz, chalcedony and hornfels (indurated shale).

Method of production

Decisions, taken on when, where and by what technique a flake should be detached, are relevant in the method of flaking. This part of the production process is the most elusive, because it requires a knowledge of how the core was set up and treated from the first detachment to the last. Proxy knowledge is supplied by examining a series of cores representing different stages in the sequence.

In reports on South African Middle Stone Age assemblages, cores have been classified into different types, primarily on attributes of shape. This is usually done without taking into account the dynamics of core reduction. In Table 1, examples in the literature of terms that have been used to classify cores are given. In the main these are sack categories and the terms do not carry information on the method of production. The adoption of such apparently arbitrary classifications has not furthered Middle Stone Age studies. A technological approach is needed to provide a basis for understanding the method of production.

The theoretical discussion in the previous section guided the selection of attributes for the study of the cores from main site. Although refitting is an ideal way to study the method of production, this was not an option here or at most occurrences in caves and shelters where there is considerable overprinting from successive occupation events. The study of method thus depends on the recognition of the different products in the core reduction sequence.

Table 1. Terminology used to describe Middle Stone Age cores

	Singer & Wymer (1982) Klasies River main site	Volman (1981) southern Cape sites	Beaumont (1978) Border Cave	Kaplan (1990) Umhlatuzana	Wadley & Harper (1989) Rose Cottage Cave	Clark (1997) Rose Cottage Cave	Mitchell (1992) Ntloana Tsoana
Levallois							✓
Radial (a)	✓ (include discoid & biconical)	✓	✓ (discoidal, blade, triangular)				
Discoid		*			✓		
Biconical		*					
Change of orientation(a)	✓	✓					
Adjacent platform *(a)	✓						
Tortoise							
Single platform *(b)	✓	✓		✓			
Opposed platforms *(b)	✓						
Other double platform	✓	✓					
Small core	✓						
Microcore	✓						
Irregular	✓	✓	✓	✓	✓	✓	
Double platform	✓	✓					
Bipolar			✓	✓			
Bladelet						✓ (one platform, & two platforms)	
Blade					✓		
Small bladelet							✓
Flat bladelet					✓		
Core reduced					✓	✓ (one platform & two platforms)	✓
Cylinder		✓					

*Volman classes biconical and discoid cores as radial cores. He recognises 2 groups of cores - (a) those for production of flakes with intersecting scars intersecting ridge core and (b) those for production of flakes with parallel, sub parallel or convergent scars (uni-directional ridge cores)

In the analysis the following attributes were noted:

i) preparation of the upper surface,

ii) the number of platforms used in the production of blanks

iii) the angle of the platform(s). The angles were measured by orientating the core against a protractor. As the platforms may bear more than one scar and the angles may differ when measured at various positions on the platform, the value is a mean. Measurements were recorded in 10 degree intervals as this is the level of precision that could be obtained in replicated measurements. This level of precision is adequate for the purpose of this study. How the platform was created was noted by recording the number of scars on the platform. All the cores can be analysed according to the same set of attributes because all can be classified as prepared cores.

In the main site sequence, there are changes in method of production of blanks and this was achieved by the knappers choosing different combinations of attributes. Prepared cores preserve the active and inactive surfaces and these can be designed to produce blade blanks (recurrent method) or point blanks. In the MSA 1 and Howiesons Poort, blade blanks were the main products whereas in the MSA ll, point blanks were almost exclusively produced. The other core categories are noted in Appendix 1.

The length, width and thickness of the prepared cores were measured. The amount of cortex present on the core was also noted (Table 12, Appendix1). The presence of dorsal ridges is a good indicator of the reduction method followed, but as most cores have been struck, it is only the blanks that retain the evidence of the preparation of the upper (active) surface. For this reason the dorsal scar patterning on blanks has been recorded (Fig. 40, Appendix 1).

Technique

Method of production, discussed above, and technique are often conflated. They need separation as different methodologies are followed in their study (Knuttson 1988:18). Technique refers to the nature of transfer of energy through percussion (Chazan 1997:721). Percussion can be by hard or soft hammer and direct or indirect. The platforms or butts of flake products carry the most technological information on the type of percussion (Dibble & Whittaker 1981; Dibble & Pelcin 1995). The study of platforms is essential because platforms represent a way of controlling flake morphology and could be manipulated by the flintknapper (Dibble 1998:613). It is not sufficient to describe the appearance of the platform, as is usual in the literature. The platform attributes have to be related explicitly to techniques and piece morphology.

There is a large body of data from material fracture science that can be used to infer whether hard of soft hammers were used in the production of stone artefacts. The prominence of the bulb of percussion, 'lipping' of the platform (lip or overhang of the platform on the main flake surface) and the platform area are the technical characteristics studied. There is agreement that a prominent bulb of percussion and large platform area, indicate the use of a hard hammer in direct percussion. However, there is less agreement on how to distinguish between direct soft hammer percussion and indirect percussion. A diffuse bulb (Cotterell & Kamminga 1987:690, 1990), small platform area (Cotterell & Kamminga 1990:140-42), and lipping (Tsirk 1979:85; Cotterell & Kamminga 1987, 1990) are thought to indicate indirect percussion. Bordes & Crabtree (1969) described these features on Upper Palaeolithic blades from Corbiac, and suggested that they indicate indirect percussion. However, there are others (Newcomer 1975, Tsirk 1979) who argue that the same features may indicate either indirect percussion or soft hammer percussion. In a test, Pelegrin (1991) replicated the Corbiac blades and he was able to show that soft hammer percussion produced them.

The material, from which the indentor or hammer is made, may further influence flake morphology (Hayden & Hutchings 1989). Dibble & Pelcin (1995:436) suggests different kinds of platforms were set up for use with hammers of different materials. It is probable that Middle Stone Age knappers switched between hammers of different materials and were competent to adjust platform characteristics as necessary. This appears to have been the case from this study of the artefacts produced.

Experiments have been designed to determine what platform characteristics are determinants of flake morphology. By dropping steel ball bearings from an electromagnet on to plate glass cores, Speth (1972), Dibble & Whittaker (1981), Dibble & Pelcin (1995) and Dibble (1997) have established that platform thickness and exterior platform angle influence the flake length and the flake thickness (Dibble & Whittaker 1981) or flake mass (Dibble & Pelcin 1995). Platform thickness is not a critical variable if the exterior angle is low but it becomes more significant if the angle is high (Dibble & Pelcin 1995:437). A high exterior angle requires more precision in knapping to obtain consistent results but has the benefit that the maximum size of the flake obtained is greater.

In another set of experiments designed to gain a measure of 'curatedness' (Shott 1996), an estimate of the original flake mass of a retouched tool was required. Davis & Shea (1998) found that the original flake mass was underestimated if only the variables of exterior platform angle and platform thickness were taken into account. They suggested that platform width should be included in the equation. While Dibble (1997, 1998) accepts that platform width is a predictor of flake mass, Pelcin (1998) considers the experiment did not take into account differences in the flint types used. In the main site samples, platform width appears to be a significant variable where the platform is thick as on the MSA ll points. However platform width seems a less critical variable when the platforms are as thin as on the Howiesons Poort blades.

Such experiments help to identify some of the variables determining the nature of percussion products. They are difficult to perform. Further progress is likely to come from computer simulations rather than actual experiments. The value is in identifying and demonstrating the inter-relatedness of key variables. In practice some of the variables, like the exterior platform angle, are difficult to measure with precision on 'real' flakes (Dibble 1998). In this study the platform characteristics that have been noted are the prominence of the bulb, platform size, presence or absence of lipping, platform angle and platform type (Fig. 40 Appendix 1). Platforms have been interpreted as either 'soft hammer' or 'hard hammer'.

Blanks

At main site, where the raw material occurs almost exclusively in cobble form, cortical and other irregular flakes are the initial products. Prepared cores are designed to produce parallel sided blade and point blanks. What are technically blades may be produced by preparing the active surface of the core either by bordering flakes struck along the laterals or by flakes struck across the upper surface to form a central ridge. In these instances the blades produced are properly debitage, if the final product is a blank of different characteristics. A good example is the blades associated with points where the point blank is the norm. Even where the active surface of the core is prepared for recurrent blade production and blades are the final products, some blades are debitage from the reduction process.

Only in the situation where the flakes can be refitted on the core, can the production sequence be followed with certainty. Even then, as each core is unique in some respects, numbers of examples are necessary to model the stages in production. In main site very few flakes can be refitted and none could be fitted to a core. Direct evidence of the sequence of removals is lacking. Thus, although some thick-sectioned blades are clearly by-products of core preparation, it may be unwarranted to assume all were such. For this reason all blades and points were analysed.

A variety of terms have been used to describe the products of the Middle Stone Age reduction sequence. Terms like pointed flake-blades (Singer & Wymer 1982:60) and convergent blades (Thackeray & Kelly 1988:18), refer to pieces classified here as points. All points display a central guiding ridge or ridges on the dorsal surface and faceting of the platform. In the samples studied, there are few examples of pointed blades that fell outside this class, in being irregular in plan form and in having cortex on the dorsal surface. These are chance products.

The description of the elongated products is more problematical. Terms like flake-blade and blade are appropriate. Singer & Wymer (1982: 50, 52) considered that the more elegant examples should be called blades but the property of elegance has no classificatory merit. Analysis of the D-sample confirmed the presence of such pieces (Tables 42 & 50, Appendix 2). A small percentage of the blades of the MSA 1, 3% (20) and lower MSA 11 (SASU sub-member), 16% (128) and upper MSA 11 (SASW sub-member) 11% (45) can be classified as 'elegant', but are termed large blades. To test whether the large blades are a different class, the metrical attributes are compared to the other blades, termed variable blades. The analysis shows the large blades are not different from the variable blades in the coefficient of variation of length, width and thickness. In the correlation between platform thickness and piece length, thickness and piece thickness and platform width and piece width (Tables 66-68, Appendix 2), the pieces are similar. The conclusion is that the large blades simply represent the tail of the size distribution and not a separate design class.

Wurz (1997, 1999) advocated the use of the term blade to describe the Howiesons Poort blanks that were retouched as segments. In her definition blades are different from flake-blades because the platform attributes indicate they were struck using a soft hammer rather than a hard hammer. This distinction is too restrictive to be operational. The simpler option is to label all elongated products in the Middle Stone Age as blades.

The points and blades are described in terms of metrical dimensions and pattern of dorsal ridges (Fig. 41, Appendix 2). The metric dimensions of the blanks of length, width and thickness are noted.

Retouch

Retouched artefacts involve additional decision steps in the *chaîne opératoire*. The following retouched types are recognised in the Middle Stone Age: notched and denticulated pieces, scrapers, backed artefacts, knives, unifacial and bifacial points and rare 'burins'. A discussion of the attributes used to analyse these categories of retouched artefacts, is given in chapter 5.

Conclusion

The Middle Stone Age can be defined as a technological stage that is characterised by the use of a prepared core technology. The core comprising two volumes that intersect in a horizontal plane identifies prepared core technology. The surface of the upper volume is the active surface and it is from this surface that flakes and blades are struck. The lower or inactive surface carries the platform or platforms of the flakes. Preparation of the lower volumes is usually centripetal. Cores of this kind occur in Acheulian, Middle Stone Age and Middle Palaeolithic contexts and in the latter they are referred to as Levallois cores. Prepared cores are designed to produce preformed flake blanks for use with little or no further shaping by retouch. By adjusting the key variables, prepared cores were used to produce different forms of blanks. At Klasies River main site, prepared cores have been used to produce blade blanks in some levels and points in other levels.

The production of artefacts can be studied with the framework of the *chaîne opératoire,* which follows a logical order from getting the raw material to discarding the used artefact. A distinction can be made between the method and technique of production. In the study of Middle Stone Age assemblages, technology provides important insights over and above any that may come from typology.

CHAPTER FIVE

ANALYSIS OF THE MIDDLE STONE AGE ARTEFACTS FROM KLASIES RIVER

Introduction

The long artefact-rich sequence at main site, covering some 60 000 years in time, has provided the opportunity to document details of the local culture-stratigraphy of the Middle Stone Age. As discussed in Chapter 2, Singer & Wymer (1982) divided the Middle Stone Age sequence into sub-stages, numbered l – lV with the Howiesons Poort industry occupying a stratigraphic position between the MSA ll and MSA lll. The sub-stages were defined mainly on typological criteria and to a lesser degree on technology. These authors (1982:64) considered that although there were changes in the sequence, they were not very marked ones with the possible exception of the Howiesons Poort sub-stage.

One of the goals of this dissertation is to evaluate the integrity of the sub-stage division that has been proposed. However, this study has less to do with description of the culture-stratigraphy than in gaining an understanding of the nature of behavioural changes that are reflected in the stone artefacts. At issue is whether the kinds of changes observed in the sequence are of a functional kind, better tools for better jobs, or whether the changes in artefact typology and technology were imposed by societal values. The latter would indicate that material culture had become part of the social domain as in modern societies. This distinction is relevant to the question of when modern behaviour can be documented in the archaeological record. In this time range artefacts are a primary source for drawing inferences on human behaviour.

The conventional approach to the description of stone artefact assemblages is typological analysis. As noted, typologies are useful as a means of data reduction, grouping like materials in samples, and typologies are used in this way here. As discussed in Chapter 4, few formal retouched tool types can be recognised in the Middle Stone Age and this limits the value of the typological approach. A complementary technological approach is advocated and the discussion of cores and their products is given as much emphasis as conventional typology.

The study of the samples from the excavation by Deacon (D-sample) forms the basis of this dissertation. These samples serve as a control to evaluate and compare with the samples excavated by Singer and Wymer (1982), referred to as SW-sample. The procedure adopted was to classify the materials into broad typological classes of chips, chunks, cores, irregular flakes, blades and points.

As shown in Fig. 10 and Fig. 11, at this gross level of analysis the content of the different layers in the site is very similar (Tables 14 & 15 (Appendix 2). The assemblage composition, the proportion of debitage and flake products, remains relatively constant. The reason is that in artefact production an enormous quantity of debitage is produced and the similarities belie significant technological changes that are only apparent on further detailed analysis. It is the gross level of analysis of assemblage composition that has given rise to the contention (Singer &Wymer 1982:64; Thackeray & Kelly 1988:17) that the main site culture-stratigraphy shows a long period of stasis.

The significance of technological changes becomes apparent in following the stages of the *chaîne opératoire*. This chapter is organised as a discussion of the steps noted in Chapter 4. These are raw material selection, method of production, technique followed in the production of blanks, description of blanks and retouch of artefacts. The data for the complete sequence available from the D-sample and where relevant the SW-sample for each step, are discussed in order. Reference can be made to Fig. 5 in Chapter 2 and Table 11 (Appendix 1) for the stratigraphic order, and to Fig. 39 (Appendix 1) for specific layers.

RAW MATERIAL SELECTION

The choice of raw materials is emphasised because the relative frequencies of materials are readily quantified and, as in the Later Stone Age, the results are patterned in time. If procurement and transport costs are seen in functionalist terms then they are high in the case of non-local materials. The real procurement costs involved in the expenditure of

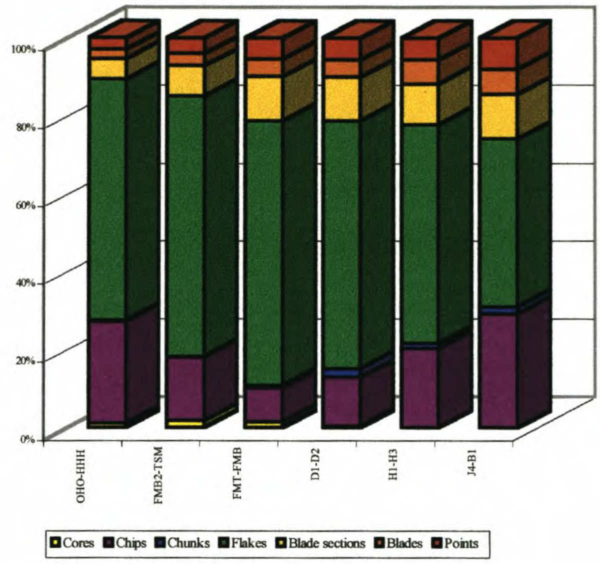


Figure 10. Assemblage composition of cave 1, D-sample.

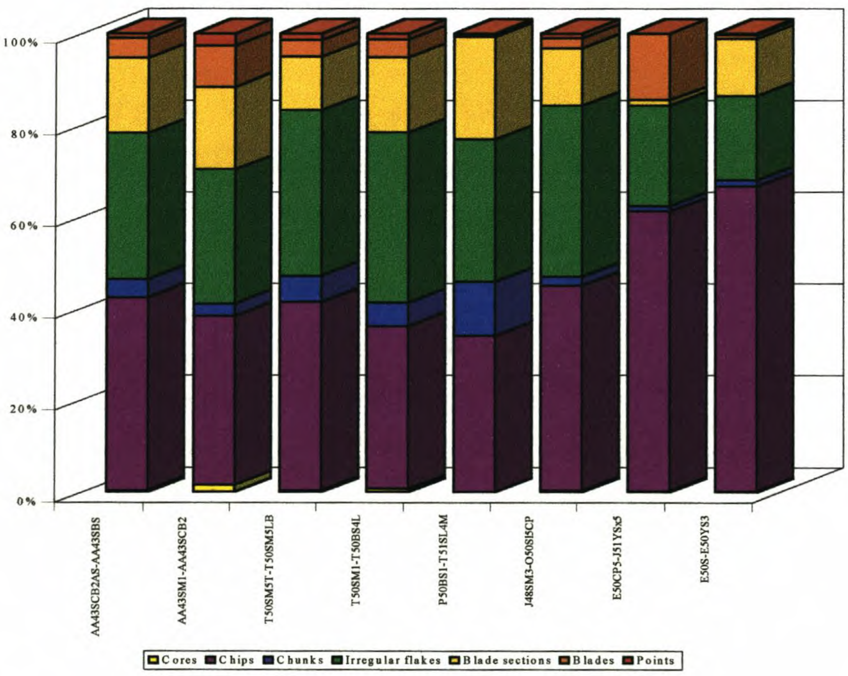


Figure 11. Assemblage composition of cave 1-1A, D-sample.

energy, may have been offset in many ways. For example, through linking the search time to getting food resources or maintaining exchange networks, the costs may have been minimal. It is unlikely the costs were consciously counted. The reasons for incurring such costs were not functional. As argued elsewhere, trends in the Middle Stone Age sequence, in the increasing and decreasing use of non-local versus local rock, is a characteristic of what Byers (1994, 1999) defines as style 2.

At main site, the term local raw material refers to quartzite. There is a source of the very high quality quartzite in the form of beach cobbles, reworked in multiple cycles of high sea level stands, adjacent to the site. The non-local, fine-grained raw materials in the sequence include silcrete, milky and glassy quartz, chalcedony and hornfels (indurated shale). The silcretes, formed pedogenically, occur in grey, red, yellow and rarely white hues. Some of the silcrete cores are larger than 25 mm, meaning that the silcrete may have been sourced either in the form of cobbles or at an outcrop. A number of cores, especially in silcrete and hornfels, retain some cortex. This is direct evidence of a cobble source. No obvious source has been located in the riverbeds and plateaux in the immediate vicinity (Singer & Wymer 1982:89). Such sources may have existed at a distance in the valleys of the larger rivers such as the Tsitsikamma (Singer & Wymer 1982:78) and more certainly in the high level gravels in the Long Kloof. River gravels or more likely colluvial deposits would have been the source of quartz. Even though actual sources have not been located, these materials are foreign to the quartzite cliff and quartzite cobble beach environment of main site. Even if additional sources of raw material were exposed during times of lower sea level, they would have still been foreign to the local environment.

The contention of Singer & Wymer (1982:44, 62) that quartzite is a coarse intractable rock of lesser quality than silcrete and other non-local materials is potentially misleading. Quartzite is harder and not as brittle, but it has particular tensile properties. These provide for a longer lasting edge than obtainable on fine-grained raw materials which, in turn, obviates the need for retouch. Middle Stone Age artificers were able to switch between materials without apparent difficulty and raw materials were not a direct control on the artefact products. Consistently cores of fine-grained materials were rejected at a later stage in the reduction of the core volume. This may be a reflection of the cost of procurement and the initial small rather than large cobble-sized starting volumes. Most probably, it reflects the ease of working relatively brittle, fine-grained material. In this context, where one raw material is not superior to another, raw material choice is culturally rather than functionally determined. The question then becomes why choose one material over another. This is discussed below.

Changes in raw material usage through time

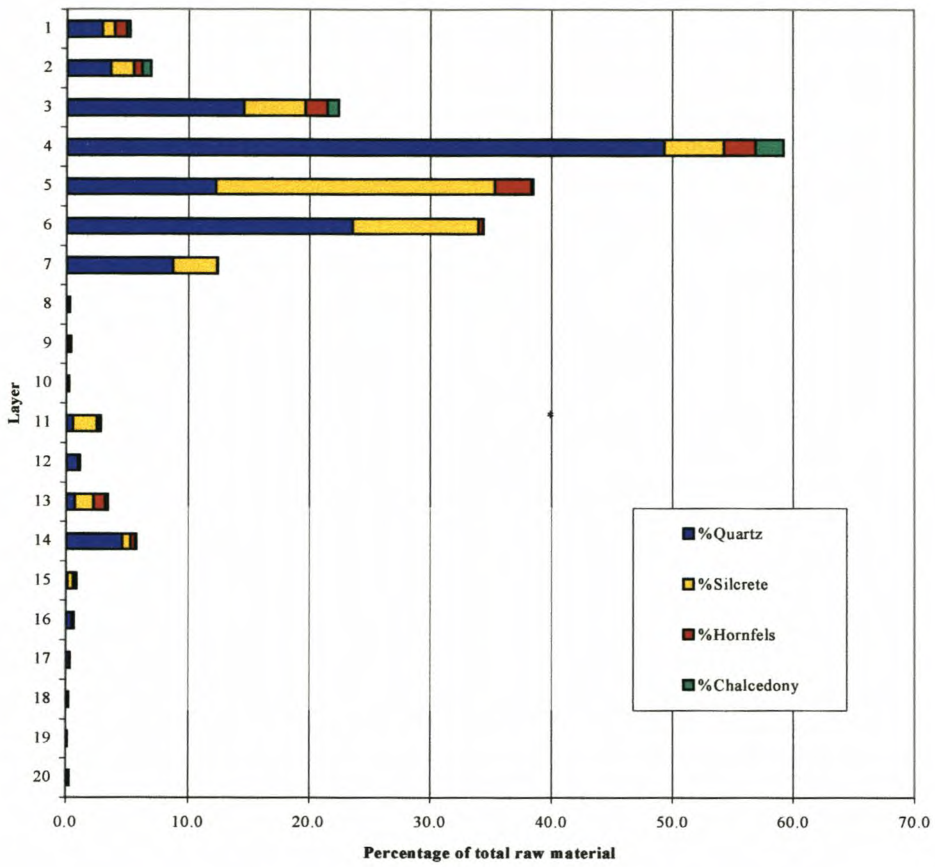
The main shift in raw material usage in the sequence at main site is the marked increase in non-quartzite raw materials in the Howiesons Poort levels. This is the culmination of a trend starting at the base of the sequence. There is a possible reduction in the frequency of artefacts in such materials in the overlying MSA lll (Fig. 12) (Tables 16 & 17, Appendix 2) (Fig. 42, Appendix 2). The trend of increasing use of non-local raw material is apparent in both the D- sample (Table 2) and the SW-sample (SW-sample).

Table 2. Summary of non-quartzite raw material usage in cave 1A, D-sample

	Quartzite (%)	Non-quartzite (%)
MSA lll (n=4993)	**93.9**	**6.1**
Howiesons Poort (n=10 210)	**67.1**	**32.9**
Upper MSA ll (n=12 900)	**77.9**	**2.1**
Lower MSA ll (n=9454)	**99.5**	**0.5**
MSA 1 (n=9944)	**99.8**	**0.2**
Total =47501		

Table 3. Raw material usage at Klasies River main site, SW-sample (Singer & Wymer 1982: 110)

	Quartzite (%)	Non-quartzite (%)
MSA lV (n=2101)	**99.3**	**0.7**
MSA lll (n=6577)	**96.0**	**4.0**
KR1A HP (n=119 336)	**73.0**	**27.0**
MSA 1l (n=95418)	**98.8**	**1.2**
MSA 1 (n=31 812)	**99.6**	**0.4**
Total = 255 244		



See table 16 (Appendix 2) for layer numbers. Layer 1 is MSA 111 and Layer 20 is MSA 1.

Figure 12. Non-local raw material percentages, cave 1A, D-sample.

In the D-sample (cave 1A), there is a five-fold increase in the use of non-local raw material in the Howiesons Poort relative to the MSA lll (Table 2; Table 16, Appendix 2). In the SW-sample, which does not include all the debitage categories, there is a seven-fold increase (Table 3). Although the use of non-local materials is more pronounced in the Howiesons Poort, an important observation is that, in the D-sample, it is initiated in prior times. The use of non-local raw material increases through the MSA ll sequence (Fig. 12). The overlying RF member is a low intensity occupation horizon, possibly representing an extended time period. The presence of non-local materials in the RF member is observable to be high, suggesting a continuation of the trend, but this cannot be quantified with precision on the available samples. If the trend in raw material usage is linear as seems to be the case, the RF member represents an effective discontinuity or break in the culture-stratigraphic and temporal sequence.

The following discussion of non-local raw material usage is based on frequencies from sample D in cave 1, cave 1A and cave 1B (Table 17, Appendix 2). The lowest incidence of non-local raw material occurs in the base of the sequence in the MSA 1. In the samples from caves 1A and 1B, the percentage of non-local raw material never exceeds 0.3 % of the total materials used. Hornfels and quartz are the non-quartzite raw materials present, with only two pieces of chalcedony and no silcrete recorded. The use of non-quartzite raw material increase to 0.5 % in the lower MSA ll and to 2.1% in the upper MSA ll. The increase is in relative frequencies and in diversity. In the upper MSA 1l, silcrete, glassy quartz, quartz and hornfels (Fig. 42, Appendix 2) are recorded. Chalcedony is never common. Singer & Wymer (1982:112) also noted a "slight increase" in the use of non-local rock towards the end of the MSA ll.

The marked increase in the Howiesons Poort layers involves the same range of materials. Quartz has the highest frequency, followed by silcrete, with hornfels also present (Fig. 12). Chalcedony is present in notable, but still small quantities, in the upper Howiesons Poort and in the MSA lll levels.

It is the non-local raw material use in the Howiesons Poort that is of particular interest, as discussed below.

Raw material selection in the Howiesons Poort

A study (Wurz 1997) of the D-sample from cave 2 showed that the increase in the use of fine-grained raw materials can be related to the production of backed artefacts. A small proportion (4%) of the total number of artefacts in the D-sample is made in non-quartzite material, while this rises to 39% in the retouched component. The better provenanced D-sample from cave 1A, provides a more reliable indication of raw material use. In this sample 33% of the total industry, and 58% (n=20) of the backed pieces, is in non-quartzite material. In the SW-sample (Singer & Wymer 1982:99), 35% of the backed artefacts (441 out of 1245) is made in fine-grained raw material. In all these samples, there is clear selection of non-local raw material for the production of backed artefacts.

Raw material selection is evident in another class of retouched artefacts, notched artefacts. The large SW-sample includes a number (n=214) of notched artefacts (Singer & Wymer 1982:99) from the Howiesons Poort. More than three-quarters of these are made in fine-grained raw materials. A sample of 130 of notched pieces was included in this analysis and the results show that 99 (76%) of the notched pieces are in silcrete, one in milky quartz and 13 (10%) in hornfels. Only 13% of the notched artefacts is in local quartzite. Selection of silcrete is particularly marked in this class.

At other sites, the backed artefact component of the Howiesons Poort is normally preferentially made on fine-grained rocks (Keller 1973; Deacon, J. 1979, 1995, Kaplan 1990; Harper 1994; Vogelsang 1996). At one extreme, 82% of the backed artefacts at Nelson Bay Cave is made in quartzite and 18% is made in silcrete and other raw materials (Volman 1981:261). This is a relatively low degree of selection although the sample is small. At Montagu Cave (Keller 1973) and the Howiesons Poort name site (Deacon, J. 1979, 1995), the backed artefacts are made exclusively in non-quartzite materials, even though quartzite was available. These sites are close to silcrete sources within the Cape Fold Mountain ranges and show a high degree of selection. In areas other than the southern Cape, a similar trend is evident. For example, at Umhlatuzana in KwaZulu-Natal, where quartzites were locally available, the backed artefacts are predominantly (88,4%) in quartz and hornfels (Kaplan 1990:17). At Rose Cottage Cave (Harper 1994) in the Free State, the majority of the backed artefacts is made in opaline silicates of a non-local origin. Nelson Bay Cave and Klasies River main site are the exceptions, in that at these sites backed artefacts were not made primarily on fine-grained rocks. However, at all sites where the Howiesons Poort occurs, there is evidence for the selection for particular materials for making backed artefacts and other tools. The degree of selection apparently reflects the distance of the sources.

In the Holocene Wilton industry, there is a direct parallel in the raw material selection for retouched artefacts. Crypto-crystalline or fine-grained rocks, and in the southern Cape, chalcedonies and silcretes, were used extensively for formal artefacts in the Wilton (Deacon, H.J. 1976). Later Stone Age assemblages also show differences in the relative proportions and diversity of materials in relation to sources (Deacon, J. 1984). As in the Middle Stone Age, the temporal trends in raw material preferences are linear and can be related to choice and not function. The implication is that the same controls on raw material choice were operative and these would have been in the exercise of stylistic expression. Patterns of raw material selection are one of the lines of evidence that point to there being no fundamental difference in the minds of Middle and Later Stone Age peoples.

METHOD OF ARTEFACT PRODUCTION

Cores provide the best opportunity to study the method of artefact production. Method is how a core is reduced to produce a blank. The approach adopted was to classify the cores in the samples into categories that reflected the production system type rather than the morphological type. Because core reduction is a dynamic process, there is no merit in classifying cores in arbitrary typological shape classes. The flake scars on the active surface of the core provide the main information on the production system. Cores that were discarded before being worked out, are the most informative. Even in large samples these are few. From an understanding of the stages of reduction, it is immediately apparent that the cores were systematically reduced and the greater majority discarded at a late stage in the reduction process.

Only half of the sample of cores is complete enough to carry information on reduction sequences. They all conform to a general Levallois-type prepared core concept (Chapter 4). However, there are differences in the core reduction strategies that are unique to parts of the stratigraphic sequence. It is these differences that are reflected in the Middle Stone Age sub-stages that have been recognised.

Two kinds of production systems are identified – a point production system and a blade production system. The point cores have prominent triangular scars where a single point has been removed. The majority of the point cores have only one platform, but some show a distal platform in addition. They make up the majority of cores in the MSA 1 and MSA 11 samples.

The blade core production system is more complex. Usually conical or cone-like cores are associated with blade production. There are a few examples in an early stage of reduction that have a cone form. It is significant that they only occur in the MSA 1 and in the Howiesons Poort levels. The majority of cores with elongated scars in the MSA 1 and in the Howiesons Poort are 'flat' rather than conical. The flatness refers to the convexity of the upper surface. They may carry two platforms with the distal platform often showing small terminating flake-scars. These cores appear to represent the later stages in a blade reduction sequence and it is inferred that the initial form of the core was conical.

Although platform angles are informative, this attribute alone has proved of limited use in differentiating between production systems. Singer & Wymer (1982:46) commented that the ideal platform angle on a core is between 75 and 85 degrees, but there can be no ideal angle. In this study, the platform angle was found to range between 50 and 90 degrees (Tables 21, 26 & 32, Appendix 2). Taking into account the angles on the few cores at an early stage of reduction, it appears that the platform angle for initial blade production from conical cores was close to 90 degrees. With progressive blade production, the platform angle was reduced to compensate for the reduction in convexity of the active surface. The platform angle on worked out cores may be as low as 50 degrees. The dynamic of core reduction mean there are changes in the platform angles and it is for this reason there is no ideal angle.

Table 4. Summary table: length, width and thickness of point and blade cores, MSA l- MSA lll

	Point cores			Blade cores		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
MSA 1 (SW sample)	**65.5** n=33	**57.6**	**29.1**	**63.2** n=18	**64.4**	**27.2**
MSA 11 lower (D-sample)	**65.1** n=67	**62.6**	**28.5**	**59.8** n=13	**58.3**	**27.7**
MSA 11 upper (D-sample)	**59.8** n=13	**58.3**	**27.7**	**61** n= 5	**62.6**	**27.6**
Howiesons Poort (SW sample, D-sample)				**43.8** n=186	**44.1**	**18.8**

MSA I

There are no informative cores in the MSA 1 levels of the D-sample, and a number of cores (n=98) from the SW-sample was analysed. The sample was chosen from the area of square a (Singer & Wymer 1982:fig. 3.2) in cave 1 adjacent to squares AA43 – Z44, excavated by Deacon. The MSA 1 cores from the are from Layer 18 (37) and Layer 19 (38).

The impressive feature of the MSA 1 technology is the production of long, thin flake products. Both point and blade cores can be identified. In the MSA 1 sample analysed, there are 34 (35%) point cores and 18 (18%) blade cores, in addition to irregular or broken cores (Table 18, Appendix 2). The proximal and distal platform angles are similar on both kinds of cores (Table 21, Appendix 2). The greater similarity is in the width, the most standardised dimension.

The blade cores have mean dimensions of 63 mm in length, 64 mm in width and 27 mm in thickness (Table 4; Table 19, Appendix 2). They are rectangular in shape and double platformed as in the Howiesons Poort levels, but they are larger and carry large blade scars. A conical core from Layer 37 (Fig. 13) in the initial stage of reduction is particularly informative. This core is considerably larger than the flat worked out cores that carry blade scars. It has a length of 96 mm and a width of 74 mm. The thickness of 68 mm is some three times that of the flat blade cores. The greater thickness reflects the more convex upper surface than is usual on the more reduced blade cores. This core has only a proximal platform and the platform angle is 90 degrees. This is consistent with the contention that double platform cores are characteristic of the later stages in the reduction sequence. The bruising and small step flaking that are typically found on the striking platforms of the MSA 1 blades and points, is evident on the proximal platform.

Figure 13. The active (left) surface and under (right) surface of a conical core, MSA l, Layer 37, square a, SW-sample.

The point cores (n=33) have a mean length of 66 mm, a mean width of 58 mm and a mean thickness of 29 mm (Table 4; Table 19, Appendix 2). These dimensions are similar to those for points in the lower MSA ll levels. Although the point cores in the MSA l and MSA ll appear similar, the products indicate clear differences. The points from the MSA l are thinner and longer, and have bruised platforms.

MSA ll

A total of 180 cores from the MSA ll levels of the D-sample was analysed. The sample for the lower MSA ll is made up of 100 cores from the cave 1, 20 cores from cave 1A and 21 cores from cave 1B. The 39 cores analysed from the upper MSA ll levels are all from the cave 1A.

There are both point and blade cores in the lower and upper MSA ll (Table 22, Appendix 2). The percentage of blade cores in the lower MSA ll (11%), and upper MSA ll (13%) is low. The blade cores in the MSA ll differ from those in the MSA l. Whereas almost all of the blade cores in the MSA l had distal platform preparation (72% n=13), very few blade cores in the lower (45% n=5) and upper MSA ll (20% n=1) had distal platform

preparation (Tables 26 & 27, Appendix 2). When distal platform preparation was present, it was less systematic than in the MSA l blade cores.

In the lower MSA ll, 67 (48%) and in the upper MSA ll, 13 (33%) cores are classified as point cores. The point cores (for example Fig. 14) are as long as they are wide, close to 60 mm in both dimensions (Table 4; Tables 23 & 24, Appendix 2). As in the MSA l, width is the most standardised dimension. The plan form of the majority is triangular. The upper surfaces are very flat, and the negative scars indicate a single removal in the most cases.

The mean length of the point cores (Table 4) is close to that of the points (Table 6). This suggests that these cores had been so reduced in volume that it was no longer possible to re-prepare them. There are few redirecting flakes in these samples and even fewer whole ones. In assemblages in the southern Cape, it is common to find redirecting flakes that are substantially larger than the cores, an observation first made by Singer & Wymer (1982:44) and repeated by others (Volman 1981; Thackeray & Kelly 1988). This shows that the cores have gone through multiple cycles of preparation and reduction before being discarded.

The main flaking activity appears to have been directed at the production of points. This is supported by the observation that there is a relationship between the size of the point cores and the points. Both cores and points become smaller upwards in the sequence. Most of the blade forms are incidental products of core preparation. No conical cores for blade production were found in the MSA ll. The few flat blade cores in this sample are less formal than in the MSA l. This confirms an observation of Singer & Wymer (1982:62). The point production system in the MSA ll is discussed below. The order followed is that used to discuss the Levallois method in Chapter 4.

Figure 14. MSA II point core, SASU sub-member, D-sample.

The point production system

The setting up of a core to produce point blanks can be described as follows (Fig. 15):

a) The preform is a quartzite cobble from which a thick flake was struck. This flake surface provides the initial platform for striking off further flakes and may have served as the proximal platform with further preparation by faceting.
b) A distal platform was rarely prepared.
c) The active upper surface was prepared by striking two blades from the proximal platform to create the guiding ridge. In the course of preparation of the upper surface, details of the treatment of the laterals may be obliterated. However, where this can be seen, it is not consistently patterned. One procedure was to remove a long triangular sectioned blade from one or both margins. These are termed bordering flakes. Centripetal flaking from the margins is present in a few examples and this procedure was to shape the laterals. A thinning flake at the junction of the guiding ridge and platform was sometimes removed.

d) The points were removed from a carefully prepared faceted platform by hard hammer percussion. The point of percussion was well below the active surface creating a thick platform in addition to a prominent bulb of percussion.

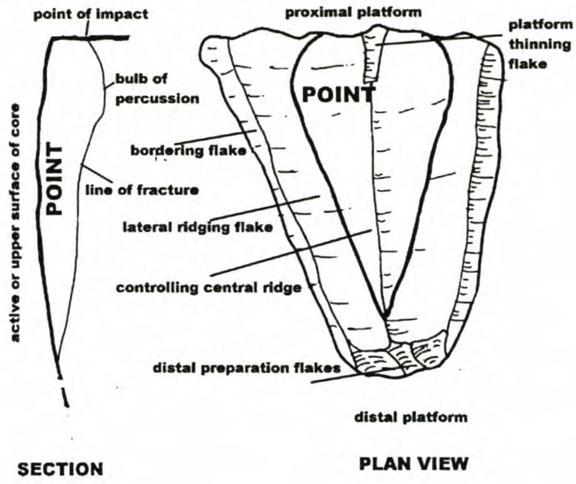


Figure 15. Diagrammatic illustration of the features of a point core.

HOWIESONS POORT

There are more cores from the Howiesons Poort than from the other Middle Stone Age levels. This has to do with sampling. Dissolution of shell in addition to the intensity of occupation explains the high artefact density in the Howiesons Poort levels. Cores from the SW-sample (n=425), D-sample from cave 1A (n=42) and D-sample from cave 2 (n=65) were analysed. Only one type, blade cores, is present (Table 28, Appendix 2). As noted, the cores resemble the blade cores from the MSA 1 and MSA ll levels. In the Howiesons Poort levels the majority of the cores are in fine-grained raw materials. Singer & Wymer (1982) recorded 366 cores in local quartzite and 524 cores in non-local raw material. In the D-sample form cave 1A 17 cores, and in the D-sample from cave 2, 8 cores, were in non-local raw material.

Singer & Wymer (1982:91) made the comment that while the cores in non-local rock were more 'methodically' worked, the treatment of quartzite cores was the same as in the other MSA 1evels. Apart from the higher frequency of core reduced pieces (fragments of reduced cores) in finer materials, this study shows no significant differences in the reduction of quartzite and non-quartzite cores (Table 29, Appendix 2). All the cores from the Howiesons Port levels conform to a single production system, as detailed below.

Core reduction was designed to produce blanks for making backed artefacts. These blanks have different characteristics from, for example, point blanks. Backed artefacts were made on thin blanks with diffuse bulbs of percussion and the cores were prepared accordingly. The prepared core or Levallois-type reduction system, the hallmark of the Middle Stone Age, was adapted for this purpose. The artefact production system in the Howiesons Poort is different in detail and not in kind from that of other Middle Stone Age industries. Singer & Wymer (1982:91) described the blade cores in the Howiesons Poort as more 'methodical' than those of the MSA l. This shows an appreciation that the Howiesons Poort cores were designed to produce blade blanks.

Singer & Wymer (1982:91) identified some of the significant attributes of the blade cores. They noted the flat and rectangular shape, maintained by dressing of sides, and commented that, in the terminology used here, only one surface was active.

The dimensions of the cores are given in Table 4 and Table 30 (Appendix 2). The width generally exceeds the length. In the SW-sample, the cores are 44 mm in length, 44 mm in width, and 19 mm in thickness. The cores in the D-sample of cave 1A are smaller and have a mean length of 36 mm, mean width of 37 mm and a mean thickness of 21 mm. The cores of the D-sample in cave 2 have similar values to those in the SW-sample. The smaller dimensions of the cores in the KR1A-84 sample have to do with sample size. The cores in non-quartzite material are smaller than the cores in quartzite (Table 31, Appendix 2). As noted, the relative brittleness of materials like silcrete allows more extended reduction.

Some of the cores that retain the preparation on the top surface are larger and more convex than the typical blade cores. These show that at the start of the production cycle, the convexity of the upper surface approaches that of the inactive lower surface. An informative core (Fig. 16) in the D-sample of cave 1A from unit CP8 in square E50 is in red silcrete and has a patch of cortex on the under-surface. It is unusual in still showing that the whole of the upper surface had been prepared centripetally by the removal of very thin bladelets. The proximal platform has an angle of 50 degrees, while the distal platform angle is approximately 30 degrees. It is wider and thicker than the average blade core and it is elongated rather than rectangular as is the norm. The length is 77 mm, the width is 58 mm and the thickness is 24 mm. Although superficially this piece appears to be bifacially worked, it carries all the technological attributes of a core.

Figure 16. Howiesons Poort blade core, upper (left) and lower (right) surfaces, Upper member, D-sample.

At the discard stage, the cores have a flat almost concave top surface. As in the other levels at main site, the redirecting or platform rejuvenation flakes evidence multiple phases of core reduction and they were struck from cores larger than most measured.

The blade production system

The *chaîne opératoire schema* for blade production is outlined below (Fig.17).

a) A thick large flake was struck from a cobble by hard hammer percussion to produce a core blank.

b) Centripetal flaking created an under-surface. The under-surfaces of the cores in the Howiesons Poort are more convex than in the MSA ll and MSA l.

c) Blade blanks were only struck from the proximal platform. The proximal platforms are different from those of point cores in the underlying levels, in showing the presence of two generations of scars. There are preparation scars, as well as a set of smaller scars, close to the striking point. The latter scars were designed to isolate the platform (Fig. 17). An opposing distal platform is a common feature but is not invariably present. In the sample analysed, 13% (n=23) of the cores lack a distal platform. However, distal platform preparation is much more common than in samples of cores from other levels.

d) A feature that sets these cores apart from those in the MSA ll, is the presence of thin, flat scars on the upper surface. This may explain the proportion of blades with multiple dorsal scars. Removing thin flakes from the low angled distal platform created the distal convexity. In accord with the Levallois production method (Chapter 4), these removals gave shape to the core and set up the ridges that controlled the termination of the blanks struck from the proximal platform. As noted in Chapter 4, *contra* Singer & Wymer (1982:91), the distal platform was not regularly prepared for the production of blanks.

As in the MSA ll point production system, lateral control was not standardised. In some examples, centripetal flaking formed the laterals. In most cases, however, the shape of the laterals was maintained by the removal of long triangular-sectioned blades along the length of the core. The scar or scars from such 'bordering flakes' are visible on 44% of the cores.

e) The blanks, the predetermined products, were struck repeatedly from the proximal platform prepared as noted under (c). A recurrent blade technology appears to have been used in the Howiesons Poort (Fig. 18) with the platform angle and convexity of the active surface critical to producing thin blanks about 40 mm in length.

f) The blanks were removed by a blow on a plane sub-parallel to the plane of the intersection of the upper and under surface. Although the Howiesons Poort cores conform in other aspects to a prepared core or Levallois-type technique, a difference is that the diffuse bulb on the blade products is not typical of the use of a hard hammer.

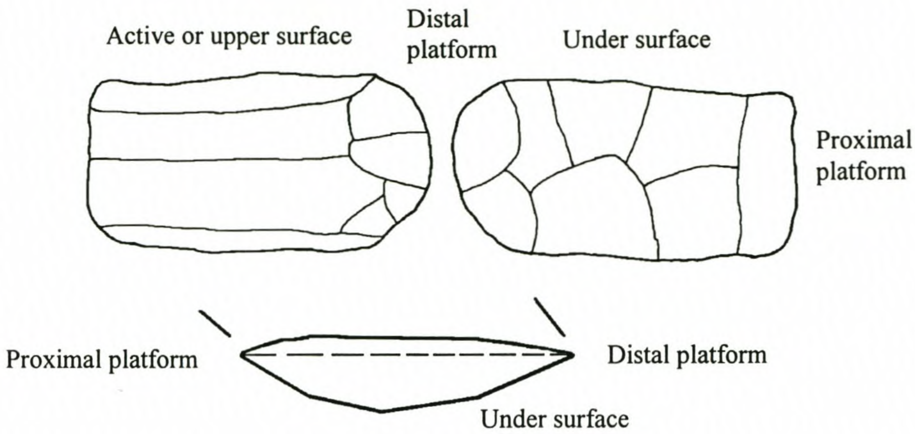


Figure 17. Diagram of a blade core.

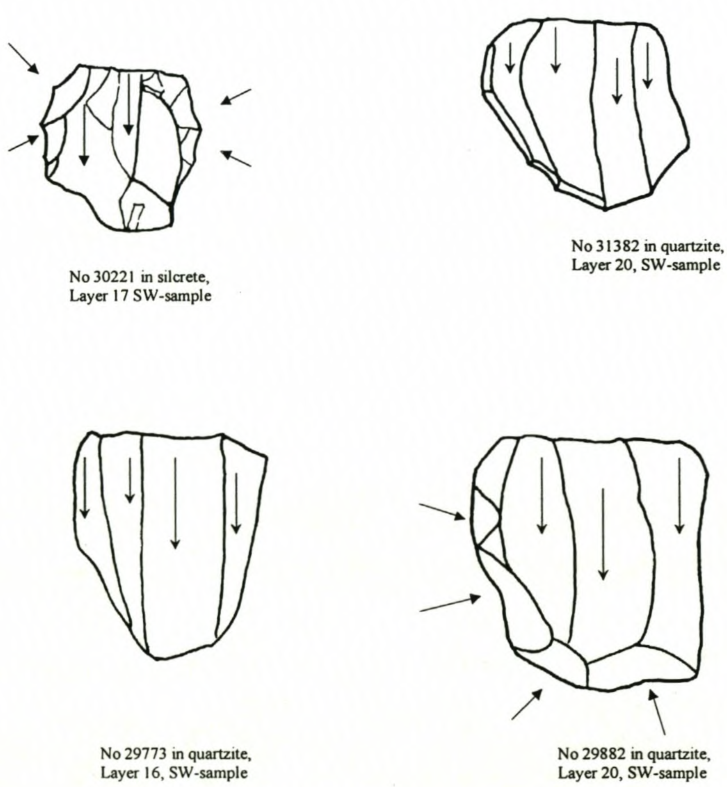


Figure 18. Illustration of Howiesons Poort cores showing centripetal preparation and recurrent blade technique (scale three-fifths of original size).

MSA lll

The D-sample of cores is small (n=11). There are no point cores in this sample. The cores were mostly too fragmentary for interpretation. Three informative cores were blade cores (Table 34, Appendix 2). Singer & Wymer (1982:48) noted a number of double platform blade cores in their sample of the MSA lll and commented that this appears to reflect a continuation with the Howiesons Poort production system. An interesting core (Fig. 19) is from square E50, unit TSC. It is possible to refit some flake products onto this silcrete core. In this example, the preparation of the active surface of the core was done by removing small bladelets to set up the controlling ridges. The proximal platform was elaborately prepared, while the distal platform is informally prepared. In these respects this core resembles cores from the Howiesons Poort, rather than the MSA ll.

Figure 19. MSA lll core, upper (left) and lower surface (right), and refitable blades, Upper member, D-sample.

BLANK PRODUCTION: TECHNIQUE AND DESCRIPTION

As discussed in Chapter 4, the blanks refer to the final rather than the initial flake products from the reduction of a core. Two kinds of blanks, points and blades are discussed. The blanks are described in terms of the platform characteristics, the length, width and thickness and dorsal patterning. A summary of the metrical dimensions is given in Tables 5 – 8.

Table 5. Summary table: platform width and platform thickness of blades and points, MSA l-MSA lll (D-sample)

	Blades		Points	
	Plwidth	**Plthickn.**	**Plwidth**	**Plthickn.**
MSA 1	**19.6** n=323	**6.8**	**25.3** n=70	**8.6**
MSA 11 1	**24.5** n=1338	**10.0**	**29.7** n=527	**11.3**
MSA 11 u	**21.4** n=655	**9.2**	**27.2** n=293	**10.4**
HP	**11.6** n=383	**3.7**	-	-
MSA 111	**20.6** n=137	**7.9**	**28.5** n=15	**11.1**

Table 6. Summary table: length, width and thickness of blades, MSA l-MSA lll (D-sample)

	Length	**Width**	**Thickn.**
MSA 1	**81.0** n=84	**28.3** n=472	**8.2**
MSA 11 lower	**75.9** n=454	**30.2** n=1791	**9.6**
MSA 11 upper	**68.8** n=244	**26.9** n=1074	**8.7**
HP (D-sample, cave 1A)	**43.9** n=75	**18.8** n=714	**4.9**
MSA 111	**77.8** n=23	**25.7** n=259	**7.7**

Table 7. Summary table: length, width and thickness of points, MSA l – MSA lll, (D-sample)

	Length	Width	Thickn.
MSA 1	**70.6** n=60	**33.5** n=71	**9.3**
MSA 11 lower	**65.3** n=414	**34.6** n=545	**11.0**
MSA 11 upper	**58.8** n=246	**31.6** n=298	**10.3**
HP	-	-	-
MSA 1ll	**64.2** n=11	**34.0** n=15	**10.2**

Table 8. Summary table: length to platform thickness ratio's of blades and points, MSA l-MSA lll, D-sample

	Blade ratios	Point ratios
MSA 1	**12:1**	**8:1**
MSA 11 lower	**8:1**	**6:1**
MSA 11 upper	**7:1**	**6:1**
HP	**12:1**	
MSA 1ll	**9:1**	**6:1**

MSA l

Technique of blade and point production

Approximately 40% of the blades show diffused bulbs, and, as discussed in Chapter 4, this may indicate the use of a soft hammer (Table 35, Appendix 2). The associated platforms (Fig. 20) are similar to those in the Howiesons Poort, but they are larger (Table 5, Tables 37 & 38, Appendix 2). A percentage of the points (13%) also have platforms with diffused bulbs (Table 35, Appendix 2). The MSA 1 points have been described as having neatly rounded butts (Singer & Wymer 1982:62). However, plain or faceted planar platforms, with prominent bulbs, are as frequent as in the lower MSA ll (Fig. 43, Appendix 2). The platform angles of the points and blades are between 90 and 60 degrees (Table 39, Appendix 2).

A characteristic of the MSA l is the presence of distinctive forms of platform preparation in the form of rubbing. The platform have been described as 'battered' (Singer & Wymer 1982: 55) or 'crushed' (Thackeray & Kelly 1988). The frequency of different types of platform preparation is set out in Table 36 (Appendix 2). Three types of platform preparation can be recognised.

- rubbing/battering/crushing in isolation
- step flaking on the dorsal surface close to the platform
- rubbing associated with stepflaking.

Over 30% of the blades and points show platform preparation. This figure is much higher than the 6% that Singer & Wymer (1982:55) recorded as 'battered' in the SW-sample from Layer 38 in the west cutting of cave 1. Some form of platform preparation is present on a more significant proportion of the blanks in the D-sample.

The preparation of the platform was to ensure the removal of long thin blanks. The controls are complex. The variables controlling flake-mass are the exterior platform angle and platform thickness (Dibble & Pelcin 1995:4343). Platform angles of the MSA l products are acute as in the Howiesons Poort levels. Blade blanks in the MSA l have ratio of length to platform thickness of 12:1, which is the same as in the Howiesons Poort (Table 8). Point blanks have a length to platform thickness ratio of 8:1 in the MSA l as opposed to 6:1 in the MSA ll. The blade character of the MSA 1 is a product of the interplay of several platform attributes and the convexity of the active surface. The preparation of the platforms may have served two different functions. The rubbing may have had to do with stopping the hammer slipping. The step flaking, on the other hand, may be preparation to isolate the platform and reduce the area over which the force of the blow was applied. While step flaking to isolate the platform occurs on the Howiesons Poort blanks, rubbing of the platform is unique to the MSA l.

Figure 20. MSA l blade platform.

Blade description

Long, thin blades have been described as characteristic of the MSA 1 (Volman 1981; Singer & Wymer 1982; Thackeray 1992). This analysis has confirmed that the most salient characteristic of the MSA l blades is their length and thinness (Fig. 21). The mean length, width and thickness are 81 mm, 28 mm and 8 mm respectively (Table 6; Table 40, Appendix 2). The dimensions of blades with diffused bulbs, equated with the use of a soft hammer, are not significantly different in dimensions from those with more prominent bulbs of percussion (Table 43, Appendix 2). The contrast is with the shorter thicker MSA ll blanks.

The MSA l blades, especially the smaller blades, show a high incidence (n=91 or 31%) of multiple scars on the dorsal surface (Table 44, Appendix 2; Fig. 47, Appendix 2). The scars are a result of fine flaking designed to form the lateral and distal convexities of the active surface. In shaping the domed active surface the invasive thin removals tend to be multi-directional and not parallel. The relatively large area of the active surface to be prepared of MSA 1 cores can account for the frequency with which multiple scars are preserved on the dorsal surfaces of blanks. Multiple scars, though in lower frequency, are recorded on the smaller blades from the Howiesons Poort levels but not elsewhere in the sequence. The reason may be that it is only in the MSA 1 and Howiesons Poort that blades are important end products.

Figure 21. MSA l blade, D-sample.

Point description

The MSA l points are shorter, wider, somewhat thicker (Table 7; Table 41, Appendix 2). They average 71 mm in length, 34 mm in width and 9 mm in thickness. They are notably symmetrical (Singer & Wymer 1982:62) (Fig. 22). The dorsal scar patterning is the same as on the points from the MSA 1l (Table 44, Appendix 2; Figure 46, Appendix2).

Points are an artefact class that occurs in the MSA 1 and the MSA 1l and this shows some continuity in design type between sub-stages. On the other hand, the blades that are a significant component of the MSA 1, anticipate blank production in the Howiesons Poort. Blade production in the MSA 1 is different from the Howiesons Poort in the blanks being larger and predominantly in quartzite. However, in technological terms there are strong close parallels.

Figure 22. MSA l points.

MSA ll

Technique of blade and point production

A feature in the MSA ll blanks is the prominent bulbs of percussion, suggesting use of a hard hammer for the production of blades and points (Fig. 23). There are points and blades with diffuse bulbs and small platforms in the upper and lower MSA ll, but such pieces are limited to the uppermost and lowermost units in the MSA ll. There are no such pieces in the units stratigraphically below K48 and above T50 SM5, in the D-sample.

The platforms of the blades are narrower and thinner (width 21 mm and thickness 9 mm) in the upper MSA ll than in the lower MSA ll (length 25 mm and thickness 10 mm) (Table 5; Table 46, Appendix 2). The point platforms of the upper MSA ll have a mean width and thickness of 27 mm and of 10 mm. The point platforms of the lower MSA ll are larger and have a mean width of 30 mm and a thickness of 11 mm.

The point and blade platforms in the MSA ll are mainly planar (plain and faceted) (Table 45, Appendix 2). There is an increase in convex faceted platforms towards the top of the MSA ll, also noted by Thackeray & Kelly (1988), and a concomitant decrease of plain platforms. The platform angles of the blades and points of the upper and lower MSA ll are between 90 and 70 degrees (Table 47, Appendix 2). There are more high angled platforms in the upper MSA 11 than in the other sub-stages.

Description of blades

Singer & Wymer (1982:53) described the blades in the MSA ll as thick and irregular. The same impression has been gained in this analysis, but it is a feature that is difficult to quantify. The best indication of the difference between the blades of the MSA 1 and MSA 11, is the length to platform thickness ratio. In the upper MSA ll the ratio is 7:1, and in the lower MSA ll, the ratio is 8:1 (Table 8). In the MSA l, the ratio between piece length and platform thickness is 12:1.

Figure 23. Main flake surface of a MSA ll point showing the prominent bulb (left) and an enlarged view of the platform (right).

Although a similar technique of production was followed throughout the MSA ll, there are differences in the dimensions of the products. The blades of the upper MSA ll, with mean dimensions of 69 mm for length, 27 mm for width and 9 mm for thickness, are shorter, narrower and thinner than the blades in the lower MSA 11 (mean length 76 mm, width 30 and thickness 10 mm) (Table 6; Table 48, Appendix 2). The dorsal scar pattern in the lower MSA ll and upper MSA ll blades is similar (Table 51, Appendix 2; Fig. 47, Appendix 2).

The trend in the dimensions, length, width and thickness of the blades in the MSA ll was investigated. In the top of the upper MSA ll, length is reduced and pieces are narrower and the thinner relative to those in the lower layers of the MSA ll (Tables 69, 70, 72, 74, 75, 77, 79, 80, 82, Appendix 2). However, the temporal trend is weakly developed and, on the available samples, no systematic change in these dimensions can be shown.

Description of points

The points are shorter, wider and thicker than the blades (Fig. 24) (Table 7, Table 49, Appendix 2). The most obvious feature is the asymmetrical thick platforms of the points (Fig. 23). Singer & Wymer (1982:60) saw this feature, as a mark of "virtual unconcern" in their production but point production is more controlled than that. There is a temporal trend and the points become smaller in all dimensions in the upper MSA ll (Tables 69, 71, 73, 74, 76, 78, 79, 81, 83). In the sample from the upper MSA ll, the correlation between platform thickness and point thickness is high (r=0.8) (Table 67, Appendix 2), perhaps indicating careful preparation of the platform to determine the thickness and width of the piece. This may explain the frequency of more rounded or arched platforms in the upper MSA ll. It has been reported previously that the points in the MSA ll become shorter and more standardised (Thackeray & Kelly 1988:20), a trend confirmed in this analysis. The value of being able to demonstrate changes in size of this kind is that it allows the seriation of isolated samples.

The pattern of scars on the dorsal surface of the points does not change. The points of the upper and lower MSA ll have similar dorsal scars (Table 51, Appendix 2; Figure 46, Appendix 2). There are no points in the lower MSA ll that have parallel dorsal scars. There is a small percentage (7%) of points in the upper MSA ll points with parallel scars.

Figure 24. Points of MSA ll lower.

HOWIESONS POORT

Technique of blade production

The blades in these levels are different from those of all other MSA sub-stages in the higher incidence of pieces with diffuse bulbs (Fig. 25). The percentage of platforms with diffuse bulbs does not exceed 50% in the MSA 1 and such platforms are rare in the MSA 11. In the Howiesons Poort levels, in the D-sample from cave 1A, 87% of the blade blanks have platforms with diffuse bulbs (Table 52, Appendix 2).

The mean platform width of the blades in the D-sample (cave 1A) is 12 mm and the mean platform thickness is 4 mm (Table 6; Table 54, Appendix 2). These values are lower than recorded in the MSA 1 sample for equivalent pieces (Table 38, Appendix 2). Most of the 'soft hammer' platforms are plain (72%), but 12% can be classified as convex faceted platforms, and 3% as planar faceted platforms (Table 52, Appendix 2). The few blanks with more prominent bulbs are faceted (3%) and these pieces may be core preparation flakes.

The platform angles are more acute than in the other levels in the site (Table 55, Appendix 2). The platform angles range between 90 and 50 degrees. The proximal angle measured on the cores has a range between 40 and 70 degrees and this may be a more reliable estimate. Platform preparation occurs (Table 53, Appendix 2), but as noted there is no equivalence of the rubbing found in the MSA 1. However, as in the MSA 1, step flaking at the platform end occurs on a proportion of blanks (16%). The step flaking may have had the purpose of shaping of the dorsal surface of the core to control piece thickness.

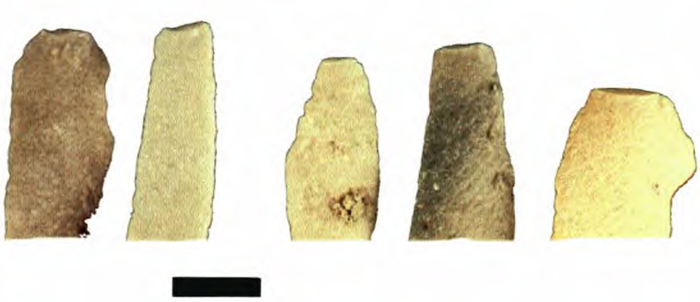


Figure 25. Platforms with diffuse bulbs from the Howiesons Poort.

Description of blades

There were virtually no points in the Howiesons Poort levels. Only 21 were recorded in the SW-sample (Singer & Wymer 1982:93) and only two were part of the D-sample (cave 2) from the unsealed surface of cave 2. The low frequency shows that the points are not a feature of this Howiesons Poort assemblage. Indeed, these examples may be chance inclusions.

The blades of the Howiesons Poort (Fig. 26) are smaller in all dimensions than those from the other MSA sub-stages. The length of the Howiesons Poort blades has a mean value of 44 mm in the D-sample of cave 1A. Other dimensions are given in Table 6 and Table 56 (Appendix 2). The blades in non-quartzite materials are smaller than the blades in quartzite (Table 57, Appendix 2). The difference in size is comparable to the difference in size between quartzite and non-quartzite cores.

The metrical parameters of the blades in the D-sample from cave 1A are similar to the parameters reported from other Howiesons Poort sites. At Montagu Cave (Keller 1973:31; Volman 1981:194) the mean 'flake' length varies from 43 mm to 52 mm for quartzite 'flakes' and from 26 mm to 37mm for non-quartzite materials. At Nelson Bay Cave, the mean length of 'blades' ranges from 48 mm to 52 mm (Volman 1981:216). Harper (1994:91) found that 84% of the blades in the Rose Cottage Cave sample were shorter than 35 mm. In the latter case, the form of the raw material, crypto-crystalline silicates from the Drakensberg volcanics, strongly influences blank size.

Most of the Howiesons Poort blanks show parallel or straight dorsal scars (Table 58, Appendix 2; Fig. 46, Appendix 2). A lower proportion has multiple scars. Some of the blades (n=71, 19%) are devoid of other than shallow dorsal scars. These are the result of flat invasive flaking to prepare the active surface of the core from which they were struck.

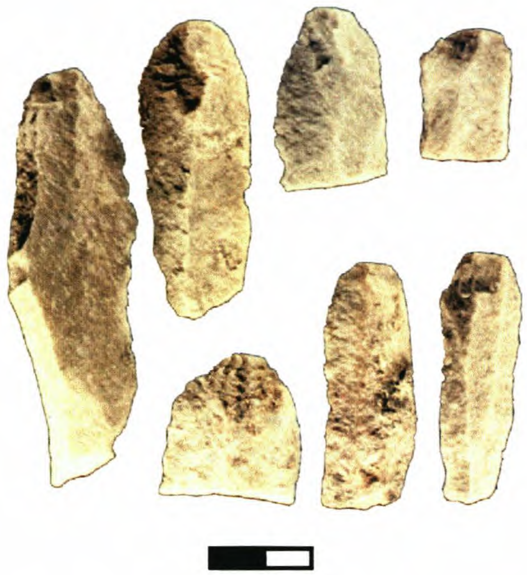


Figure 26. Howiesons Poort blades.

MSA lll

The study of the MSA lll artefacts is constrained by the small sample size. The artefacts from the MSA lll levels in the D-sample (Singer & Wymer 1982:109) is unselected but small. Thicker sterile interbeds in these topmost deposits indicate occupation diminished and the generation of sufficiently large samples is a problem.

Technique of blade and point production

Platforms with diffuse (13%, n=18) and prominent bulbs (n=137, 88%) occur in the MSA lll (Table 59, Appendix 2). The mean platform dimensions for blades are width 22 mm and thickness 8 mm (Table 5; Table 60, Appendix 2). These values are larger in the sample from the Howiesons Poort levels. They are similar to the dimensions of blades in the MSA ll upper and MSA l levels. However, the platforms with diffused bulbs are as small in size as those in the Howiesons Poort levels (Table 61, Appendix 2). These have mean thickness of 11 mm and a width of 3 mm. Singer & Wymer (1982) considered that the presence of small blades with thin and rounded platforms in the MSA lll, especially in layer 6, was possibly the result of the mixing. Such pieces occurred in square E50 from the top unit to the interface with the Howiesons Poort (Table 62, Appendix 2). This indicates that mixing was not a factor and these pieces do occur *in situ* in very low frequencies. The silcrete core and refittable flakes illustrated in Fig. 19 show that in the preparation of the upper surface, thin blades and flakes with diffused bulbs and small platforms were produced. Such pieces were not intentional end products. In the MSA l a similar explanation can be offered for the occurrence of small blades.

The majority of the platforms are associated with prominent bulbs. These platforms are plain (40%,n=62) or informally faceted (18%, n=28). The impression gained is that the faceting on the platforms of the MSA lll is informal and platforms were less well-prepared than in the other Middle Stone Age levels. This accords with the observation of Singer & Wymer (1982:78) that some platforms in the MSA lll were thick and irregular. However, they noted that, in the MSA lll, the striking platforms of the pieces in non-local rock, 246 pieces out of a total of some 6500, were carefully prepared. There are too few pieces of non-local material in the KR1A-84 sample to confirm this. Platform preparation in the form of a very thin triangular thinning flake was observed on 12% of the blades. Platform angles are mostly between 90 and 70 degrees (Table 63, Appendix 2).

Blade description

In their dimensions the blades of the MSA lll are different from those in the Howiesons Poort and the MSA ll and most similar to those in the MSA l (Table 6). The mean values for blade length, width and thickness are 78 mm, 26 mm and 8 mm respectively (Table 6; Table 64, Appendix 2). The dorsal scar patterning on the MSA lll products (Table 65, Appendix 2, Figure 47, Appendix 2) is similar to those in the Howiesons Poort.

Point description

There were few points relative to blades in the MSA lll levels (Singer & Wymer 1982:62) (Fig. 27). The dimensions of the points are comparable to the lower MSA ll (Table 7;

Table 60, Appendix 2) The dorsal scar patterning (Table 65, Appendix 2) on the points as well as the blades indicate that there was little preparation from the distal end of the core.

Figure 27. MSA III points.

RETOUCHED ARTEFACTS

Two categories of retouched artefacts are recognised, informal and formal. Informal retouch is damage to an edge that is visible to the naked eye. Retouch may take the form of fine nibbling or dulling of the edge but may be more pronounced if the product of heavy use. Although retouch can be defined as intentional shaping of an edge, no clear distinction can be made between edge modification through use and by design. It is assumed that notching and denticulation of edges is the product of use rather than intentional shaping. For this reason edge modification in the form of denticulation and notching is classified as informal retouch. The implication is that these features were produced through working hard materials.

The formally retouched artefacts discussed are invasive retouched (unifacial and bifacial pieces), backed artefacts, *outil écaillés*, burins, scrapers and knives. Some of these are restricted to certain levels.

INFORMAL RETOUCH

Lateral damage

It is absence rather than the presence of clearly visible signs of edge modification, that is a feature of the Klasies River Middle Stone Age artefact samples. The raw materials, like quartzite and to a lesser extent silcrete, are tough or not very brittle. On many pieces with long sharp laterals, use-wear is not obvious although there is a high probability the edges were created for a function and the pieces were indeed used. There is potential for microscopic examination of edges for use-wear and for the study of traces of residues on the artefacts. Such studies would be a major undertaking and have not been attempted. The graininess and hardness of quartzite explains the low incidence of edge damage and edges in this material are naturally serrated. They do not need reinforcement by retouch. As the quality of the edge is created by the primary release from the core, re-sharpening is not an option.

Lateral damage in the form of edge nibbling, where obvious, was recorded as utilization. The frequency is lowest on the blades in the Howiesons Poort units and highest in the MSA ll (Table 86, Appendix 2). Singer & Wymer (1982:109) reported that edge damage is a noteworthy feature on pieces in the MSA lll, but less a feature in the MSA l. In this analysis the frequency of edge damage is equally low in the MSA l and MSA lll. The reported information on the incidence of edge damage in the form of utilisation and notching in the MSA l in Singer & Wymer (1982:69) is misleading because all the artefacts from cave 1B were included in the MSA l whereas the upper part of this deposits is related to the MSA ll.

Notching

Notching is more extensive localised edge damage. It is a feature of the MSA ll, and, to a lesser extent, of the MSA l. In the D-sample in the lower MSA ll, 13.3% (n=311) and in the upper MSA ll, 7.9% (n=108) of the pieces are notched (Table 86, Appendix 2). These notches are about 2 mm deep and the edges inside the notches are slightly dulled. They are different from the notches discussed in the Howiesons Poort. In the D-sample, very few pieces in the Howiesons Poort are notched (n=11), but in the larger SW-sample there are numerous examples of notched pieces as discussed in detail below.

Denticulation

Denticulation is a series of notches along an edge. Notching grades into denticulation suggesting no difference in function. Dibble & Rolland (1992) state that most forms of denticulates are repeatedly re-used and re-sharpened notched pieces. While this is easier to accept for irregular notched pieces, it is less plausible for regular, evenly spaced denticulations aligned along a single edge (Mellars 1996b). Singer & Wymer (1982) speculated that denticulation denotes a specialised activity. They ruled out working of hard materials and a comb-like function and thought they would have been ineffective as saws. From the literature (Singer & Wymer 1982:73; Volman 1981) the impression gained is that denticulates are more prominent in the MSA l. Examination of the material from the D-sample showed there are fewer denticulates in the MSA l (0.9%) than in the MSA ll (2.4%). Denticulation and notching increases in the MSA ll.

Edge-damage on blades and points in the MSA 1-ll

The edge-damage on blades and points from the MSA l and ll was compared, because these levels provide adequate samples for a meaningful comparison. From Table 87 (Appendix 2) and Fig. 28 it is apparent that points show a higher incidence of lateral use damage than blades. The points in the upper MSA ll have the highest incidence (41.6%, n=124). Notching and denticulation are again more common on points than on blades and the highest frequency for both is on the points from the lower MSA ll. 'Oakleaf' points

(Fig. 33a), defined as having denticulation along both laterals, occur in the lower MSA ll in cave 1. There are only four and none was recovered from the upper MSA ll units.

In the sample examined, there are no retouched pieces in the MSA l. In the MSA ll, retouch is on the points, rather than on blades. Retouch tends to be localised at the tip of the points, at the shoulder of the point, or sometimes on the ventral surface of the platform, as noted by Singer & Wymer (1982:71). In the few cases where retouch occurs on blades, it is on the shoulder of the piece, or on a transverse break.

It is widely held that points were hafted (Mason 1962) and served as parts of projectiles, spears rather than arrows. The evidence is indirect and includes the thinning of the butts by retouch and notching of laterals. Singer & Wymer (1982:62) attempted to explain the high frequency of points lacking any retouch as overproduction. Almost half the points show some obvious form of edge damage but little or no formal retouch, and this argues against overproduction as an explanation. The incidence of edge-damage suggests that points were functional artefacts that were seldom shaped by retouch. The probability that they were hafted must be high because getting leverage would be difficult if they were hand held. This leaves open the question of how they were hafted and to what purpose.

Notched and denticulated pieces in the Howiesons Poort

Notches

The blades in the KR1A-84 sample from the Howiesons Poort units show less lateral damage, notching and denticulation than in the units of the other MSA sub-stages. In the large SW-sample, the notched artefacts are present in sufficient frequency to warrant detailed description. Singer & Wymer (1982:100) described the notches on the Howiesons Poort blades as "varying greatly in size, position on the edge of a flake blade and in general arrangement". However, they considered that notched artefacts constituted

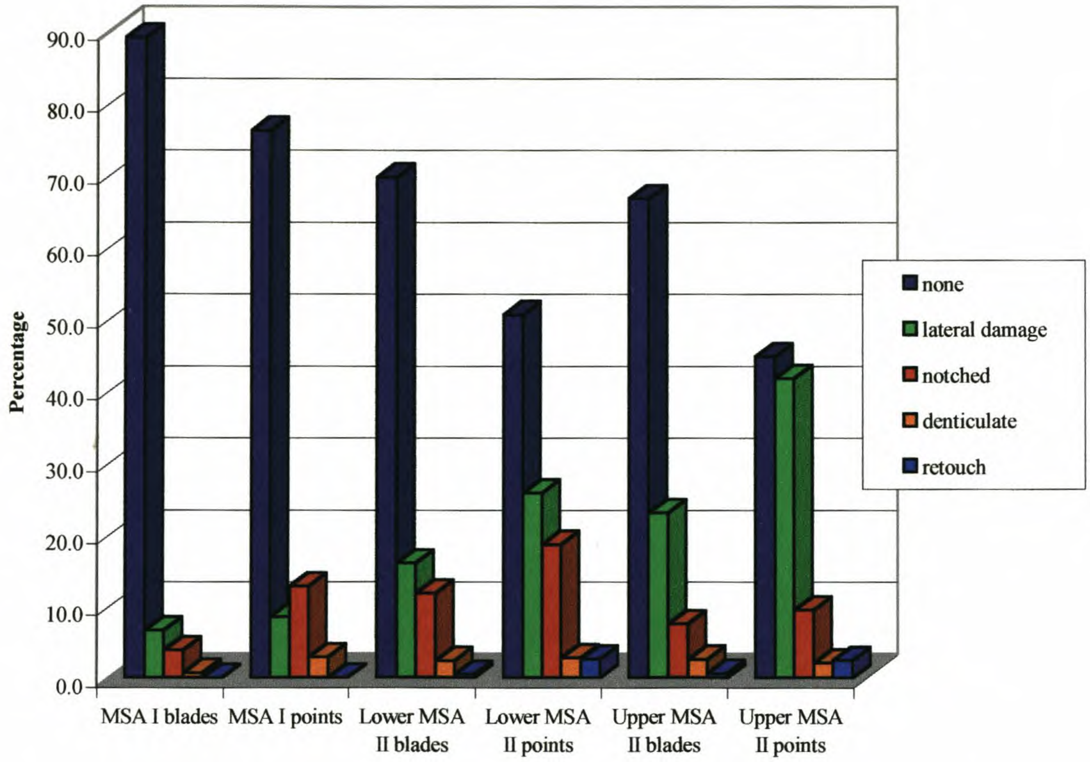


Figure 28. Graph of damage on blades vs points from MSA I and MSA II, D-sample.

a formal artefact type. They (1982:100) reported recovering 214 such pieces. Of these 131 were located and have been analysed (Fig. 33e). Three kinds of notches have been identified.

(a) Break-out notches are flat and even on the inside. Often two adjacent notches of this kind occur, connected by a small intermediate notch. The break-out notches are not dulled within the concavity.

(b) Complex notches are formed by the removal of small flakes from within the notches.

(c) Woodwork notches are wide (broad) open notches showing step flaking within the notch (Fig. 29). They may be associated with scalar flakes released from the under surface. This kind of working is identical to that seen on adzes in the Later Stone Age.

Descriptive statistics of the notched artefacts are given in Table 88 (Appendix 2). The depth of the concavity is maximally 4 mm, and the length of the notch up to 20 mm.

Figure 29. Howiesons Poort woodwork notches.

It is possible that these apparently different classes of notches are simply different stages of use-wear, related to the damage of the edge caused by working hard material like wood. Some break-out notches may be caused by heat spalling or even breakage with compaction in the deposit and may not have been deliberate working. Use-wear data on notch-type damage (Anderson-Gerfaud 1990) and comparison to adze-type working on Later Stone Age tools support an interpretation that notched pieces were used as planes or scrapers for shaping wooden shafts or stakes. These are light duty, relatively small tools that could have been used in working thin shafts.

The same kind of blanks were used in the manufacture of the notched pieces and backed artefacts. On 56% of the notched pieces analysed, the platform was present. In all cases the platforms are small, angled and associated with a lip and diffuse bulb. The majority of these pieces are in silcrete (76%). Fewer were made in hornfels (13%) and quartzite (14%), with a single example in milky quartz.

To determine the intensity of use of the notched pieces, the number of notches per piece was counted (Table 89, Appendix 2). The majority of the pieces have one notch, with reducing frequencies of pieces with two or more notches. This J-type or Poisson distribution is associated with chance events and suggests there is no significance in the number of notches along an edge. All the notches are accompanied by damage on the laterals. In a few cases the notches are associated with backing. Of the backed artefacts, 17% (Table 98, Appendix 2) show notched damage.

Denticulates

Singer & Wymer (1982:104) reported that denticulates or multiple serrations were absent in the Howiesons Poort. However, some 35 pieces (23%) were located in the Howiesons Poort of the SW-sample. They include two pieces, in quartzite and hornfels, and the remainder is in silcrete. The denticulated pieces tend to be longer than the notched pieces (Table 90, Appendix 2), but there are only three whole denticulated pieces.

FORMAL RETOUCH

The number of stone artefacts shaped by formal retouch is extraordinarily low, of the order of one in a thousand (0.001%; 104 of a total of 76 256 in the D-sample). The incidence rises the Howiesons Poort units (2.6%) (Table 86, Appendix 2). The classes of formal artefact types that have been recorded from the site include invasive retouched (unifacial and bifacial points), *outil ecaillees,* backed artefacts, burins and scrapers.

Invasive (unifacial and bifacial) retouch

This type of retouch is shallow and can occur on the dorsal and/or main flake surfaces. The definitions of unifacial and bifacial points adopted by Singer and Wymer (1982:67) are that the retouch should extend over half or more of the length of the pieces. This would exclude invasive retouch restricted to shaping of the butt or the tip of the point. There seems little significance in whether invasive retouch was unifacial or bifacial.

The incidence of invasive retouched pieces (Singer & Wymer 1982:69) is reported as neglible in the MSA l with unifacial points occurring in small numbers in the MSA ll and MSA lll. The only complete but unfinished bifacial 'Still Bay' point came from the surface scree below cave 1A and could have eroded out of the deposits containing MSA 11 or younger artefacts. Singer & Wymer (1982:72) recorded an increase in retouched pieces in the top levels of the MSA ll. Five out of seven unifacial points in the MSA 11 were recovered from layers 22-25, culture-stratigraphically immediately below the Howiesons Poort. Of the 22 pieces with invasive bifacial retouch found in the MSA ll, 17 come from these layers. These may represent the culture-stratigraphic position of a 'Still Bay' horizon in the sequence.

In the very large SW-sample of artefacts from the Howiesons Poort layers at main site there are few pieces showing invasive flaking and these are mainly from the base (Layer 20). One is a broken bifacial point in dark red silcrete, retouched along both margins. In addition, there are five other possible bifacially worked pieces. There are individual, bifacially worked pieces from each of layers 17, 11 and 18. There are additional specimens from cave 2. The 1967/8 investigation recorded a long unifacial point from the surface of cave 2 and a broken bifacial point in hornfels cemented to the cave wall about one metre above the surface of the Howiesons Poort deposits. Due to the collapse of the sediment pile with diagenesis, the stratigraphic position of the latter is uncertain. Another bifacially worked piece in red silcrete (Wurz 1997:fig. 12) was recovered in the D-sample from cave 2.

The incidence of invasive retouch in the Howiesons Poort levels at main site is very low. It may be significant that more invasively retouched artefacts come from the base of this part of the sequence. Although bifacial points have been recorded from the name site of the Howiesons Poort (Deacon, J. 1995), further excavations of sealed contexts will be necessary to establish the relationship between bifacial-rich points occurrences as reported from Blombos Cave (Henshilwood & Sealy 1997) and the Howiesons Poort occurrences. In Appendix 3 the site of Paardeberg is discussed. This site includes bifacial points and the blade blanks resemble those in the Howiesons Poort.

Outil écaillés

The term literally means battered tools and has been used to describe a set of 23 artefacts from the 1967/8 excavation (Singer & Wymer 1982). All are in silcrete. All are from the Howiesons Poort sub-stage and all, but one, are from the lower levels, 15-20. They are rectangular, thin pieces that Singer & Wymer (1982:104) considered being specialised 'chisel-adze'-like tools (Fig. 30). However these authors noted resemblance to their class of micro-cores. Since their study, the recognition of *outil écaillés* as a typological class has been questioned. The consensus is that such artefacts are not design types but they are the products of extended core reduction (Callahan 1987). This is the view taken here.

In support of the interpretation of *outil écaillés* as core reduced pieces, it can be noted that all the pieces are in fine-grained silcrete that lends itself to extended reduction. It is noteworthy that similar pieces occur in the Middle Stone Age assemblage from Paardeberg in the Long Kloof where silcrete is the main raw material. No *outil écaillés* have been reported from other quartzite dominated levels in the main site sequence.

Figure 30. Two faces of an *outil écaillés* from the Howiesons Poort, SW-sample.

Backing as retouch

In the samples of stone artefacts from the Howiesons Poort levels, retouch has been used to shape the blanks. The Howiesons Poort is unique in the Middle Stone Age sequence at main site in that blades, of a particular size, were retouched into geometric shapes.

A total of 828 backed artefacts from the top cutting from the Singer and Wymer excavation was analysed. The small numbers of backed artefacts present in the D-sample from cave 2 (n=74) and cave 1A (n=28) samples were also analysed. Of interest in the production of the backed artefacts in terms of the *chaîne opératoire* is the decisions that were made in the selection of raw materials and in blunting and sizing the piece through retouch. These are style-2 type decisions and they are part of an argument that symbolic communication is evidenced by the production of such artefacts.

A proportion of the backed artefacts was made in non-quartzite raw materials (Tables 91-93, Appendix 2). In the D-sample from cave 2, 41% (n=30), cave 1A 25% (n=7) and in the SW-sample 46% (n=386) of these artefacts were made in non-local raw material. Raw material selection has been discussed previously.

Production of the backed artefacts

The platforms and the thicker proximal ends of the blade blanks are preserved on the backed artefacts (Fig. 33c). This means those whole blades, and not sections of blades were the blanks that were retouched as backed artefacts (Wurz 1999). The application of any notch and snap technique as suggested by Singer and Wymer (1982:98) can be ruled out. The notching of blades had a different function and they are not rejects from the use of this technique.

To assess the size range of the blanks that were chosen for the production of backed artefacts, an index of selection (Chazan 1995) has been calculated. The blade blanks from the D-sample from cave 1A (n=75) have been used, as this has provided an unselected sample of blades to compare with a sample of backed artefacts in the SW-sample. The index divides the percentage of retouched pieces in a given range by the percentage of total blade blanks in the same range. For example, if 3.6% of the backed artefacts are between 16 and 20 mm long while 2.9% of the blades fall into the same class, then the index of selection would be 3.6/2.9 or 1.2. A low index of selection (<1) indicates that a given range is underrepresented in the retouched pieces, an index of 1 indicates that a size range is equally represented in the retouched and unretouched pieces while an index of >1 indicates overrepresentation in the retouched pieces. The index of selection (Table 99,

Appendix 2) indicates that blades in the smaller range, between 20 and 40 mm, were favoured for the production of backed artefacts. These analyses shows that whole blanks of between 16 and 40 mm were retouched as backed artefacts.

The sequence in the production of the backed artefacts can be described as follows (Fig. 31). Whole blades were selected. Removal of a burin-like spall from one or both ends of the blank created a backing surface. There are examples of partly backed artefacts (Fig. 31, 32 & 33c), on which the 'naturally blunted' portion has been left unretouched. In most cases the proximal and distal sections of the blades were backed, usually from the ventral surface. Half of the backed pieces (53%) (Table 95, Appendix 2) were backed along the whole of the edge.

In general, the middle section shows finer backing than the end sections. This is because the lateral of the blank was backed without further preparation. In cross section, most backed artefacts are triangular in shape. The backing can be classified as "light" (Movius *et al.* 1968:39) and little of the original width of blank has been lost. The backing does not approach the dorsal ridge(s). As a result the width measurements of the blanks and backed artefacts are similar (Table 56 & Tables 91 – 93, Appendix 2).

Description of the backed artefacts

The length of the backed artefacts ranges from 9 mm to 72 mm (Tables 91-93, Appendix 2). The extreme values are the outliers. Large samples give mean values for length that are close to 40 mm (Table 9). The mean length of backed artefacts in fine-grained raw material is 4 mm smaller than the mean in quartzite. This is not a meaningful difference. The mean width is 16 mm and the height is 5 mm.

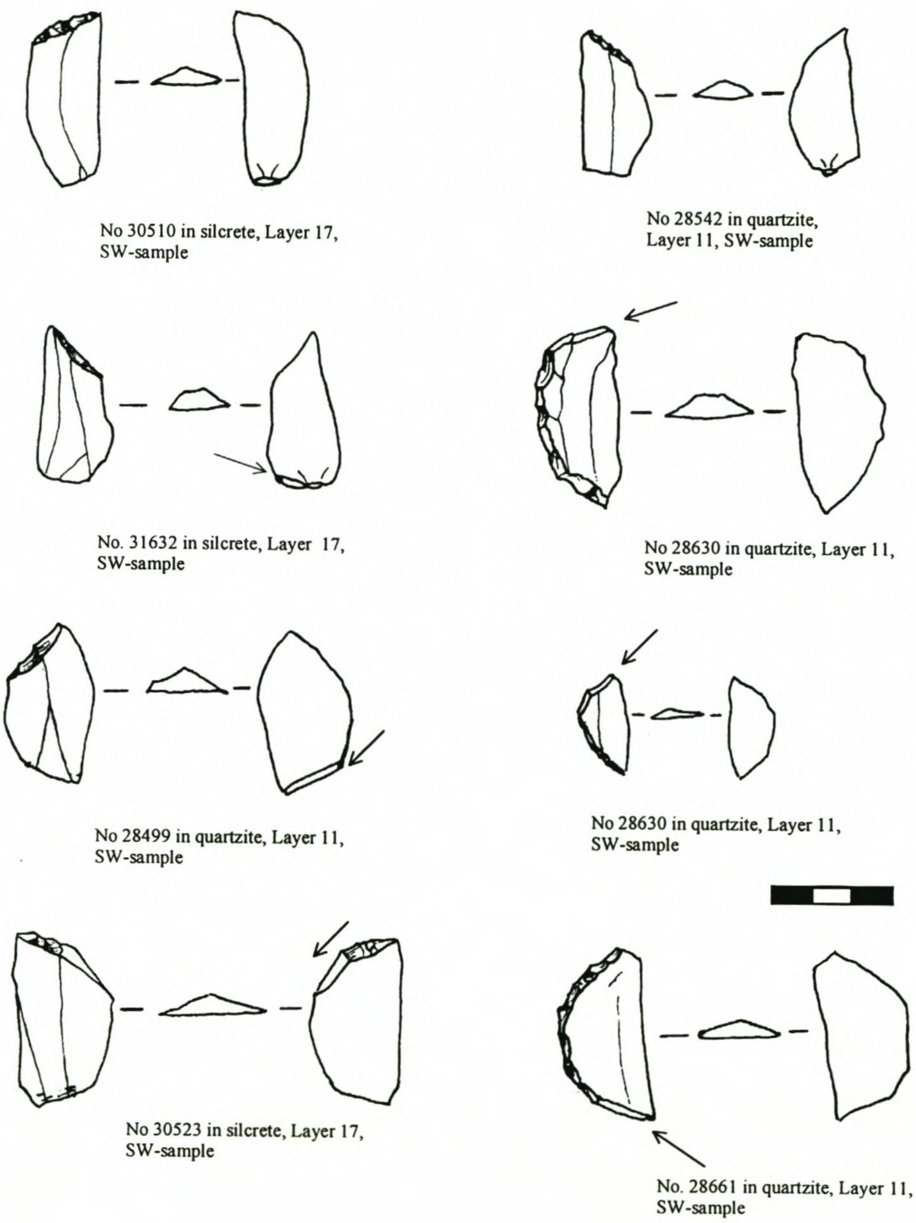


Figure 31. Backed artefacts from the Howiesons Poort, SW-sample, reduction sequence.

The degree to which an artefact is standardised (Mellars 1991) is a measure of the degree to which it has been planned to fit an ideal form or template. The coefficient of variation is an indication of the variation in a metric class, and is used as an indicator of standardisation. The variable over which the artificer could exercise most control or choice is the length. To gain a measure of the relative standardisation, the coefficients of variation of length of backed artefacts in the main site samples were compared to other Middle Stone Age samples and similar artefacts in Later Stone Age samples (Table 9). It is evident that backed artefacts from the Middle and Later Stone Age have similar coefficients of variation. In the Later Stone Age, this degree of standardisation is accepted as an attribute of style because the artificiers were modern people. Expressions of style are accepted as normal in the Later Stone Age. The backed artefacts of the Howiesons Poort were design types that were as standardised as those found in the Later Stone Age and Epipalaeolithic contexts, and are also an expression of style.

Table 9. Comparison of length of Howiesons Poort and Wilton backed artefacts

SITE	n=	Mean	CV
Klasies River (SW=sample)	**630**	**36.6**	**26**
Klasies River (D-sample cave 1A)	**28**	**35.1**	**28**
Nelson Bay Cave (segments) (Volman 1981)	**45**	**46.1**	**16**
Montagu Cave (segments) (Keller 1973)	**37**	**29.9**	**23**
Border Cave (Beaumont 1978)	**16**	**47.7**	**-**
Mumba (Mehlman 1989)	**27**	**34.2**	**29**
Melkhoutboom (LSA) (Deacon, H.J. 1976)	**101**	**11.9**	**24**
Wilton (LSA) (Deacon, J. 1972)	**54**	**15.4**	**25**
Uniondale (LSA) (Leslie-Brooker 1987)	**178**	**17.2**	**19**

It is anticipated that a stylistic indicator would show change through the temporal sequence. There is a tendency for backed artefacts to be longer in the lower layers and shorter in the upper layers, while the within sample coefficients of variation remain much the same (Table 94, Appendix 2).

Standardisation of shape

There is a degree of standardisation in shape similar to that in length. It has been argued elsewhere that trapezes and segments are related forms, and that they can be included in a single class (Wurz 1997). The expectation is that most of the backed artefacts would conform to the idealised segment-shape, with intermediate forms the next most common class and trapezes the least common. Analysis has confirmed that most of the backed artefacts, (60%) are half-moon or segment-shaped, 29% are intermediate and 11% trapeze-shaped (Table 96, Appendix 2) (Fig. 32). This belies the suggestion (Singer & Wymer 1982:112) that trapezes and segments served different functions.

Several authors have assumed (Singer & Wymer 1982; Harper 1994; Volman 1984) that variations in shape between segment and trapeze-forms in sequential layers may have cultural significance. Singer & Wymer (1982:95) found no trapezes in layer 10-14 at Klasies River. Harper (1994) also has reported that trapezes are uncommon in the upper layers of Rose Cottage Cave. An examination of the proportional representation of shapes (Table 97, Appendix 2) in the Klasies River sequence revealed that there are indeed fewer trapezes in the upper levels of the Howiesons Poort, but not a complete absence. There are also substantially fewer segments and more intermediate shapes in layers 15 to 17. Sampling limitations and idiosyncratic variation seem to underlie such differences and any stylistic significance is indeterminate.

Edge damage on backed artefacts

The nature of the damage opposite the backed edge was noted in the SW-sample. A number of the backed artefacts were broken (n=99). These are the remnants of backed artefacts that were used as tools and not discards in the manufacturing process as reported for backed bladelets from Highlands (Deacon, H.J. 1976) and restated by Close & Sampson (1998). The broken artefacts show the same degree of utilisation wear as the whole backed artefacts and they were included in counts of edge damaged backed artefacts. Seven classes of damage were recorded (Table 98, Appendix 2).

Figure 32. Backed artefacts, ventral and dorsal faces, Howiesons Poort, SW-sample.

The "light" and "heavy" class of damage is the same as the "lateral damage" on the artefacts from main site. It can be described as fine "nibbling" and is irregular and may have been the result of utilisation. Such edge-damage has been interpreted as utilisation by Movius *et al.* (1968:46). There is a possibility that some edge damage is the result of post-depositional processes. However, a third of the backed artefacts show no such damage. This weakens the possibility that post-depositional processes were a factor. The edge-modification may be related to the function. Clark (1977) has described fine nibbling or edge damage on stone inserts on projectiles in ethnographic collections and considers this has the function of strengthening the edge.

A proportion of the backed artefacts has notches. These notches are similar to those that occur on the points in the other MSA levels. There is a very low incidence of backed artefacts (4.5%) with multiple notches of the complex kind. Singer & Wymer (1982) have suggested that notches may have facilitated hafting of segments. It seems more probable that they were hafted in mastic as in the Later Stone Age (Deacon, H.J. 1966) and not bound or inserted into the haft. It is inferred that the backed artefacts, like backed artefacts in Upper Palaeolithic (Nuzhnyi 1989, 1990) and historical (Clark *et al.* 1974; Clark 1977; Deacon, J. 1992) contexts, were parts of composite projectiles.

Burins

Singer & Wymer (1982:75) were aware that the identification of gravers or burins in the South African Middle Stone Age had been questioned but maintained that there were acceptable examples in the main site sequence. They classified 23, 41 and 11 pieces in the MSA l, MSA ll and MSA lll layers respectively as gravers. A further 18 artefacts, "a few suspect, but the remainder well-made, unequivocal examples" were recognised in the Howiesons Poort.

The first step in burin production is to prepare a spall removal surface. This is the defining attribute for the recognition of the categories of a truncation burin, dihedral burin or a break burin. A truncation burin has a spall removal surface (SRS) that consists of a retouched or prepared truncation. A dihedral burin has a SRS formed by a previous spall removal(s). The SRS is a snap in the category of a burin on a break. The sample of burins in the Howiesons Poort levels have been analysed to test whether this typological class of artefacts has any validity in the context of the South African Middle Stone Age. The attributes set out by Movius *et al.* (1968) were used in the analysis.

On re-analysis, eight of pieces identified by Singer & Wymer as burins are convincing as technically burins. The dimensions are given in Table 100 (Appendix 2). They vary in size and are not standardised in any way. Of the eight burins, there are four retouched, two break, one dihedral and one truncated burin. Five were made in silcrete, and three in quartzite. In seven of the eight pieces, the burin edge has been produced at the proximal end. The burin spall width varies between 4 – 6 mm and in all cases a single spall was removed. None shows convincing damage on the burin edge. This is in contrast to the pronounced damage reported on the working edge of the Upper Palaeolithic burins that were used to work antler (Mellars 1996b).

The occurrence of burin-type artefacts in the Howiesons Poort and the other MSA levels is a chance by-product rather than an intentional end product. The occurrence of burins is not a typological link to burin-rich assemblages of the Upper Palaeolithic in the Near East or Europe that it as was once considered (Heese 1933). In the absence of deer that shed their antlers, it is inherently improbable that burin-rich industries, like those of the Upper Palaeolithic, would be found in the African Middle Stone Age.

Scrapers

Singer & Wymer (1982:75) described round scrapers on thick flakes as the commonest form, although large and small end-scrapers occur in the samples. They used the term 'scraper' as a sack category, more in accord with archaeological convention than in implying function. Thus, although a number of pieces show steep retouch, not all represent deliberate products. In a study by Anderson-Gerfaud (1990) pieces with scraper-like retouch in the Middle Palaeolithic could be grouped in a class with other Mousterian woodworking tools rather than with skin-working tools (Mellars 1996b:124). There are examples in the samples from main site that can be interpreted as skin-working tools.

The following numbers of scrapers were identified by Singer & Wymer in cave 1 and cave 1A: MSA l:63, MSA ll: 199, MSA lll: 20. In the D-sample five scrapers were recovered. All are in quartzite.

The term scraper is reserved here for those pieces that, by analogy with the Later Stone Age, were used for skin scraping. These pieces are intentionally produced end-scrapers and carry important implications of working leather probably for clothing. A primary attribute of a skin scraper is the curvature of the working edge. The scraper edge is formed by retouch, less steep than that of backing retouch to produce the curvature. In addition to retouch shaping the front contour, a characteristic of a skin scraper is a second lower set of micro-scars on the edge. The length, width and thickness of the scrapers are noted.

In the Howiesons Poort layers of the SW-sample, 57 pieces were classified as end-scrapers (Singer & Wymer 1982:98-100), 50 in quartzite and seven in fine-grained raw material. They were described as exhibiting neat and regular workmanship. Of these 31 were located and analysed. Fifteen of these pieces show the attributes associated with skin scrapers as described above (Fig. 33b). The blanks on which the scrapers were made are relatively thicker than those for the backed artefacts. Apart from two examples made in silcrete, all are in quartzite. The radius of the curvature of the working edge is 20 mm. An exception is a silcrete scraper with a radius of 10 mm (Table 101, Appendix 2). The occurrence of scrapers of this type is suggestive of the working of leather. In Later Stone Age contexts such artefacts are used for making clothing but have a much higher relative frequency.

Knives

Only two pieces have been recovered from the MSA lll levels of the D-sample that can be classified as knives (Fig. 33d). These are not standardised in size, but the kind and placement of retouch is standardised. The knives have flat retouch along the full extent of one or both laterals. A further 10 MSA lll knives were located in the SW-sample. These conform to the description above.

Grinding

Signer & Wymer (1982:85) found no evidence for grinding activities in the form of pounders, rubbers and quern stones. In the D-sample there are two possible grindstones, both from Howiesons Poort levels. One of these is from cave 2 and is a small rubber. The other is from cave 1A, unit CP8 in square E50. It is a cobble with flecks of ochre that occur on the surface. These are not formal artefacts that would constitute a typological class as in the Later Stone Age.

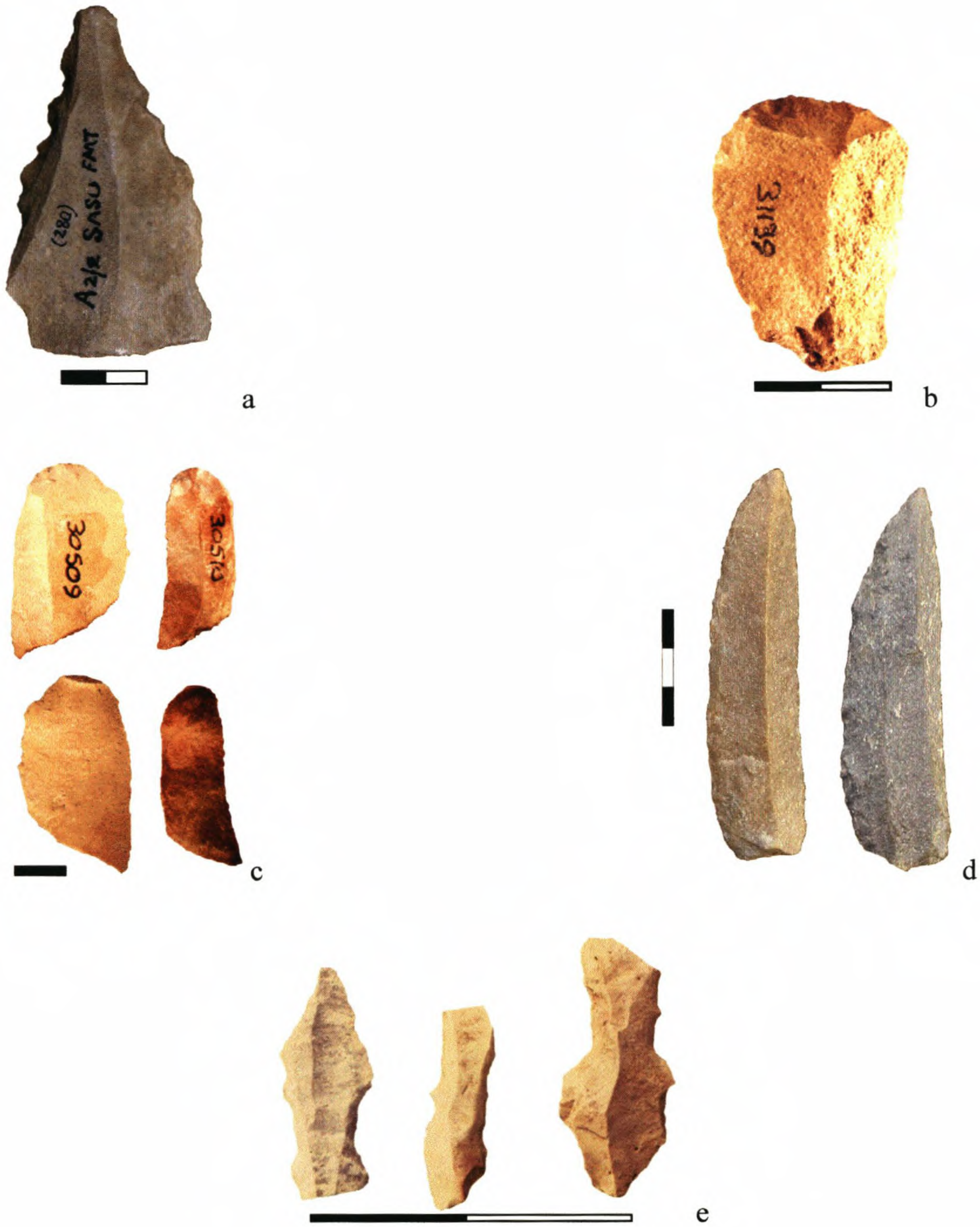


Figure 33 a) Oakleaf point from lower MSA II, D-sample; b) Scrapers from the Howiesons Poort levels, SW-sample; c) Howiesons Poort backed artefacts retaining platform, SW-sample; d) Knives from the MSA III levels, SW-sample; e) Notched artefacts from the Howiesons Poort, SW-sample.

DISCUSSION

There is a large collection of artefacts from the main site excavations. They are samples from different parts of the site and different stratigraphic units. All excavations are sampling exercises designed for some purpose and the resolution of the data obtained varies accordingly. There are advantages in having a large sample like the SW-sample for analysis even if it is biased in some respects. In any artefact analysis and, especially in one focussed on determining the mode of artefact production, samples of artefacts cannot be too large.

The use of the Levallois-type method of artefact production gives the Middle Stone Age samples from main site a unity. This method involves the production of preformed blanks, which are infrequently retouched. In the study of preformed artefacts, typological analysis alone is not informative. This gross sameness of the artefact products belies the complexity of the technology involved in the reduction sequences. The key to understanding changes in artefact production lies in detailing different strategies adopted in making preforms. The strategies can be analysed through study of the method of production, and the techniques of production followed, in producing preforms or blanks. Only by complementing typological studies with technological analyses, can Middle Stone Age artefact samples be adequately described.

In this analysis, the major sub-stage divisions recognised by Singer & Wymer (1982) have been accepted. These culture-stratigraphic divisions have been found to be sufficiently robust to justify retention. It is necessary to group sets of layers into larger entities or sub-stages in the analysis of a long culture-stratigraphic sequence like at main site. Although the sub-stages are arbitrary in their definition, they are real in that the boundaries are chosen to correspond to changes in typology and technology. The sub-stages can be used in describing and analysing the characteristics of the artefact content in the temporal sequence. This assists in identifying stylistic trends.

The stylistic traits that can be discerned in each of the sub-stages, from oldest to youngest, are summarised below. The descriptions are again organised according to the steps of the *chaîne opératoire*, raw material selection, method of artefact production, technique and description of preforms/blanks and retouch.

MSA I

Raw material selection: There is little or no selection of non-local raw materials

Method of production: The cores were shaped with a convex active surface. In further reduction stages this convexity was maintained by the removal of small blades. These removals are evident in the multiple dorsal scar patterns on the products. This gives the artefact production method a distinctive character in the Middle Stone Age sequence.

Technique of blank production: Bruising and rubbing prepared the striking platforms. It is inferred that both soft (diffuse bulb, lipping and small platform area) and hard hammer (prominent bulb, thick platform) techniques were used to obtain long thin blades and points.

Description of blanks: The blades and points tend to be longer and thinner than in the younger sub-stages (Fig. 34 & 35). The MSA 1 blades have the same length to platform thickness as blades in the Howiesons Poort industry. In technological terms the MSA 1 is more similar to the Howiesons Poort than it is to the other Middle Stone Age sub-stages.

Retouch: Very little formal retouch occurs on the products. Denticulation is not a feature of the MSA 1.

MSA II

Raw material selection: There is an increase in the incidence of non-local raw material, from zero to some 3%.

Method of production: The cores were prepared for the removal of a single or a sequence of individual points by parallel flaking creating a central ridge. The dorsal preparation of the products struck from these cores is simple. The flake removal was from a prepared proximal platform and the point of impact was set well below the active surface.

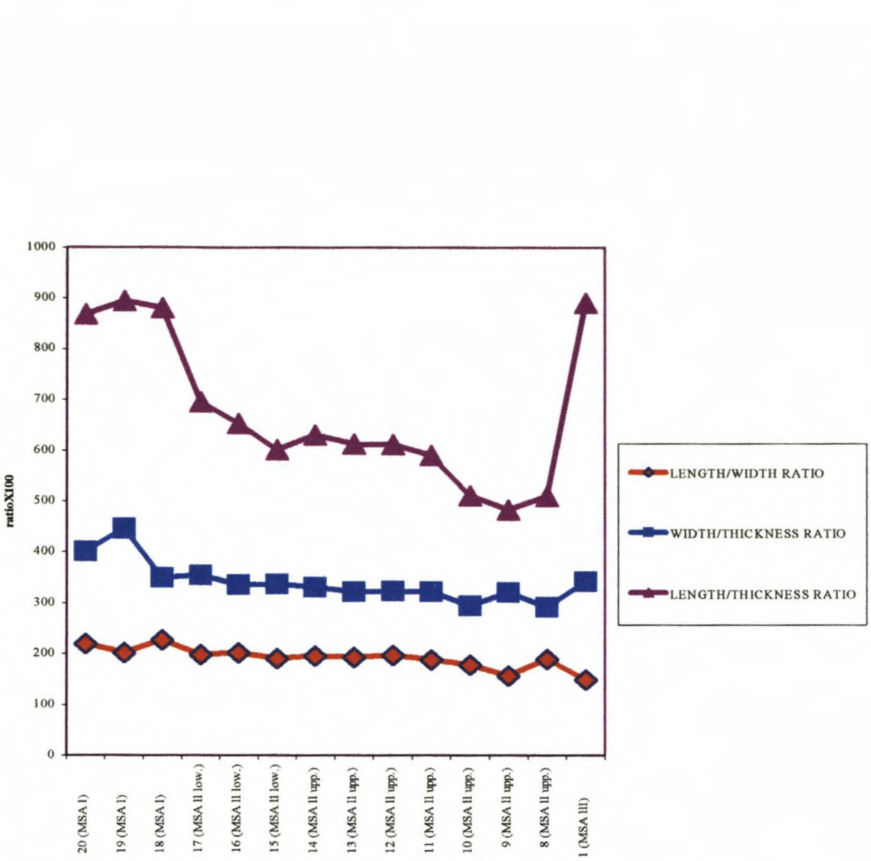


Figure 34. Point length, width and thickness ratios, temporal change, D-sample (cave 1 and cave 1A).

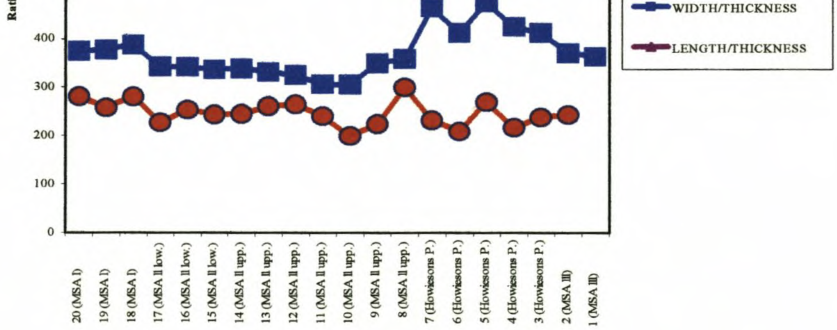


Figure 35. Blade length, width and thickness ratios, temporal change, D-sample (cave 1 and cave 1A).

Technique of blank production: The platforms are thick with a prominent bulb of percussion probably indicating the use of a hard hammer.

Description of blanks: The primary intended products are points rather than blades. There is a trend for points to become shorter or 'stubby' towards the top of the MSA 11 sequence (Fig. 34).

Retouch: Informal retouch is present on a number of the points in the form of notching. Formal retouch is infrequent. For the most part it is localised at the tip, shoulder or ventral side of the platform of the point. The few unifacial and bifacial pieces from the SW-sample come from the top levels.

Howiesons Poort

Raw material: There is a five-fold increase in the use of non-local raw material relative to the MSA 11.

Method of production: The cores were prepared in a manner similar to that in the MSA 1. The initial core form was conical but with reduction it takes on a rectangular shape. The preparation of the active surface consisted of removing flat bladelets from the outer margin to retain the convexity. An essential feature of the preparation of the proximal platform was the removal of trimming flakes to control the point of percussion. Distal platforms are frequently but not invariably present.

Technique of production: The presence of small, plain and lipped platforms with diffused bulbs of percussion indicates an almost exclusive use of a soft hammer. The platforms are off-centre to the main axis and high angled suggesting a billet (hammer) of soft material like wood was used.

Description of blanks: The blanks are relatively short (40 mm), thin blades.

Retouch: Informal retouch is in the form of notching and the wide notch possibly produced in working wood is noteworthy. The backing of whole blades as segments is one of the well-established typological characteristics.

MSA lll

Raw material: The use of non-local raw material, as in the Howiesons Poort, remains relatively high.

Method of production: The method of core configuration appears similar to that in the Howiesons Poort in the production of blades, but in addition, points were produced.

Technique of production: There are both small, 'soft hammer' and large 'hard hammer' platformed blades. The platforms are not prepared in the same fashion as in the MSA 11 and preparation is not standardised.

Description of blanks: The sample is not sufficient to characterise the blanks except to indicate they tend to be similar to the Howiesons Poort with an additional larger component.

Retouch: The noteworthy feature is the serrated retouch on the so-called knives.

The paucity of retouched artefacts in the sample gives the impression that it is only in the Howiesons Poort levels that there is significant change (Singer & Wymer 1982). The selection of non-local raw material for making backed artefacts, the adze-like notched pieces and the restricted occurrence of backed artefacts themselves to these levels is typologically important. This does not gainsay the significance of preformed rather than retouched types like points that occur in the MSA ll. More difficult to evaluate in the sequence are what appear to be standardised types but which occur in low frequencies because of sampling constraints or because they were rarely made. Examples would be knives in the sample of the MSA lll or again formal skin dressing-type scrapers in the Howiesons Poort and other levels. Burins and *outil écaillés* can be discounted as formal types.

In conceptualising this investigation in terms of a *chaîne opératoire*, the study of the method of artefact production or the core reduction sequence became the central focus. Perhaps it is not surprising that most of the cores, which are of prime interest in understanding artefact production, are worked out. The number of cores rejected at intermediate stages in the reduction sequence is few. Nevertheless, it has been possible to suggest the initial core forms in the sequences and the type of blank that it was intended to produce.

The technological changes through the sequence are informative and important. In the base of the sequence conical cores were used to produce long, thin blades and points. The control exercised over the variables determining the blank form is noteworthy and denotes a well-established tradition of skills. Although these are the oldest artefacts from the site and dating to some 115 000 years ago, the method and technique of production is too well developed for these artefacts to represent other than an advanced sub-stage in the Middle Stone Age tradition. The Late Pleistocene deposits at main site include only part of the Middle Stone Age stage. The occurrence of blades older than 100 000 years would not be unique to this site or to Middle Stone Age sites in the sub-continent. This is discussed in Chapter 6.

Noteworthy in the sequence is the switch to point production in the MSA 11, using what can best be described as a classic Levallois-type technology. This is a well-represented sub-stage in the site as it relates to the thickest sequence of layers. The technological shift was an arbitrary change in the conventions relating to platform angle, width and thickness in artefact production. The point of percussion, set low down on a wide faceted platform, is a feature that is readily recognised on the blanks. The intentioned products are convergent-sided pieces or points. The convergence of the laterals is not the result of convergent flaking in preparation of the active surface of the core. It has to do with the creation of a ridge or arris, formed by parallel flaking from the proximal platform, guiding rupture initiated at a wide, thick platform. The convention included the use of a 'hard hammer' with the result that the platform is buttressed by a prominent bulb of percussion. There is a trend through the sequence for point blanks to become shorter in time, a stylistic drift that culminated in redundancy as shown by the near absence of points in the Howiesons Poort.

There is an increase in the frequency of bifacially worked pieces in the topmost layers of the MSA ll, but there is no culture-stratigraphic division at main site that can be held to present a discrete 'Still Bay' sub-stage. A 'Still Bay' sub-stage may be represented at the inland site of Paardeberg (Appendix 3).

It is the use of retouch to shape blanks in the Howiesons Poort that has drawn the most attention. This has seemed to set the Howiesons Poort sub-stage apart from the other divisions in the sequence. Although the type of retouch is distinctive, there are similarities in blade blank production between the MSA 1 and the Howiesons Poort. In the Howiesons Poort the method of production was directed at making small, very thin blade preforms that could be turned into backed artefacts. There is increased selection of non-local raw materials, but local rocks were worked in the same way. A recurrent blade technology involving control of platform angles and proximal and distal convexities of the active surface of the cores was involved. It is the high angled, extremely small, off-centre platforms of the blanks that is the hallmark of this technology.

Some of the strongest evidence for fluctuating stylistic norms of artefact production in the sequence, is that the making of backed artefacts became redundant (Wurz 1999) in the time represented in the overlying MSA lll layers.. Formal artefacts like serrated knives in the MSA lll are indicative of the development of a new set of arbitrary conventions. The post-Howiesons Poort occurrence in this site have not been adequately sampled for full interpretation of subsequent trends.

The sequence at main site is a record of change. This record can only be read with the appropriate tools. One of these is the understanding of Levallois-type technology. The products of this technology, detailed in this chapter, provide the basis for the recognition of arbitrary conventions in making stone artefacts. The recognition of arbitrary conventions is important because they can be linked to symbolic communication, the hallmark of modern humans.

CHAPTER SIX

OCHRE AND BONE ARTEFACTS IN THE MAIN SITE SEQUENCE

Introduction

In addition to stone artefacts, there are two important classes of material culture represented at main site that have significance in arguments about symbolic behaviour. These are the pigment, ochre, and bone artefacts. Ochre is relatively common in that the sample includes several hundred pieces. Bone artefacts are rare and number less than 10.

Ochre

Ochre is present throughout the sequence. It occurs in a variety of forms - as very small fragments, as 'ochre crayons', and as unshaped blocks of larger than 4 cm^2. Boyd *et al.* (1995:100) question the validity of numerically recording the pieces ochre recovered at archaeological sites. They argue that the form of plaques (slabs) and crayons may result from the natural tabular or columnar habit of haematite and not from design. This is not the case in this sample where shape has been imposed on the natural form by grinding. There are striations running in different directions and the points are rounded but not worn down (Fig. 36a). The grinding of the surfaces is not in question but any use as drawing crayons is speculative. The deeper striations are from scoring of the surface possibly to produce powder.

SW-sample

Singer & Wymer (1982:105) report four pieces of tabular quartzite between 100 and 200 mm long in their Layer 19 (Howiesons Poort). One bears faint traces of what may be red pigment. The following quantities of ochre from main site were found (Singer & Wymer 1982:117): 3 pieces from MSA lV, 25 from MSA lll, 144 from the Howiesons Poort, 36 from MSA ll and 14 from MSA l. More than the reported 144 pieces of ochre was located from the Howiesons Poort levels of the SW-sample, and 167 pieces was studied under low magnification (10x – 30x) using a binocular microscope. Forty-five of the pieces (26%) (Table 102, Appendix 2) had striations on one or more facets, and/or were shaped to form crayons. The ochre pieces included in the SW-sample are all 3 cm^2 or larger. The SW-sample underestimates the frequency of worked ochre because large meshed screens were used.

A piece of a dark red or maroon coloured ochre with three circular holes included in the SW-sample (Fig. 36b) is noteworthy. It came from the base of the Howiesons Poort layers (Layer 21). Singer & Wymer (1982:117) reported the holes as smooth semiperforations, between 4 and 7 mm in diameter and equally deep. They considered them to be artificial and that the smoothness indicated they were drilled with either bone or wood.

The colour is distinctive and darker than the common light red coloured ochre in the site. It may have a high manganese content. The sides of the holes are vertical or even slightly bell-shaped and there are no tooling marks to suggest that they are artificial. The holes are trace fossils of a burrowing organism. A number of terrestrial and marine organisms have a burrowing habit. The example shown in Fig. 36c is of holes of similar size bored in Plio-Pleistocene limestone from the western Cape coast by ship-worms (*Teredo* spp). There is no reason to suppose the holes are artificial.

D-sample

In the smaller D-sample, more than half (n=6, Table 103, Appendix 2) of the total number of utilised pieces of ochre (n=11) were in 1 cm^2 size class. In the D-sample there are two pieces from the MSA 1, five each from the lower and upper MSA 11, 47 from the Howiesons Poort, and 33 from the MSA lll. Twenty-three of a total of 92 pieces have striations and some are shaped to form crayons.

There are a number of artefacts or manuports with ochre staining in the D-sample. Several ochre-stained artefacts were recovered from Square T50 in the levels of MSA 11. In this case there are ochre fragments in the deposit. Other artefacts including a cobble with ochre staining come from the Upper member. In none of these examples is there incontrovertible evidence for direct association between the artefact and working ochre. However, the ochre pieces show grinding and grinding would have been done on a rough stone surface. It is to be expected that some artefacts with ochre staining would be recovered. As a soft material, the powdering of ochre would not have required special equipment.

Bone Artefacts

Bone artefacts are common in some Later Stone Age contexts, whereas they are relatively uncommon in Middle Stone Age assemblages. There are some undoubted artefacts made in bone from main site. These include three denticulated pieces, a piece with possible striations and a slender ground bone point from the 1967/8 excavation (Singer & Wymer 1982:115) and a bone fragment with a short polished point from the 1995 witness baulk excavation. These are described in more detail below. The order is from the oldest to the youngest occurrence.

31819

This artefact is a denticulate section of rib bone from the base of the lower MSA ll in cave 1A (Layer 36). It was found in association with 31820 (Singer & Wymer 1982:115, fig.8.1) and is part of the same artefact but there is no common join. The pieces are described separately. The bone artefact (Fig. 37a) is a rib fragment and shows root markings. The length is 110 mm, the width is 28 mm and the thickness is 7 mm and there are breaks at both ends. On the unbroken edge the denticulation runs from the middle to the end of the piece, a length of 55 mm. There is a total of 10 denticulations and the denticulation becomes more pronounced towards the end of the artefact, with seven in the last 20 mm of the tool. The denticulations are 12 mm wide and 1 mm deep. Making multiple parallel cuts into the edge to breaking out a portion created the denticulation. Sawing from one surface made the cuts. Considerable force was used in making the cuts because in making the third denticulation from the beginning of the series in the middle of the tool the cutting implement slipped and left a striation across the surface from top to bottom.

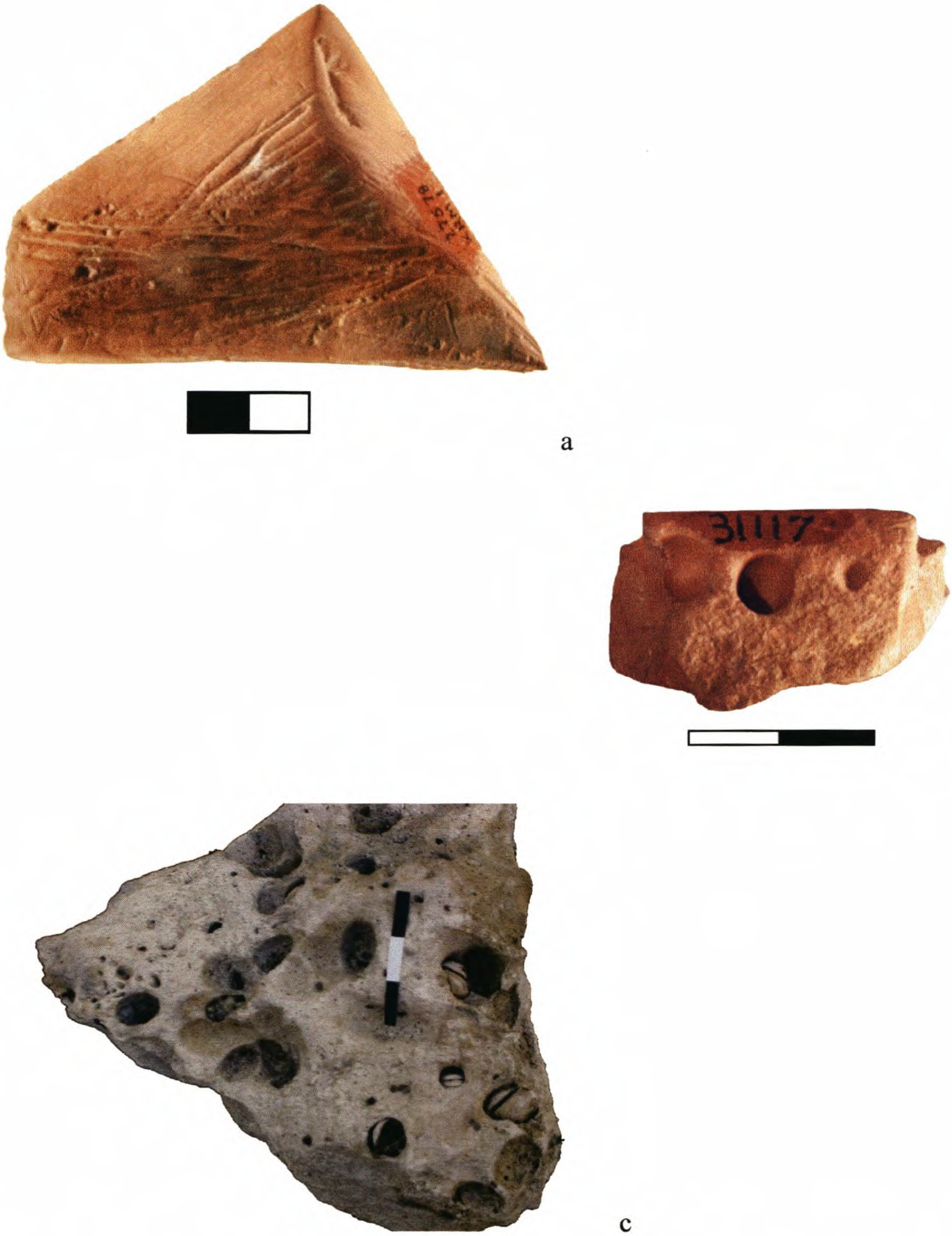


Figure 36. a) Sub-triangular ochre pencil, SW-sample (27578), cave 1, MSA II Layer 14; b) Ochre with naturally drilled 'holes' (SW-sample 31117), cave 1A Layer 21, base of the Howiesons Poort; c) Plio-Pleistocene limestone with fossil 'shipworms' and burrows.

There are deep striations on the piece. The majority was made on the side from which the notches were cut, but there are two on the other face. There are also finer striations that run diagonally across the face of the bone. Whereas the edge notching is non-functional, the scratch marks have been caused by abrasion through use of the artefact.

31820

The total length of this piece (Fig. 37b) is 42 mm, the width is 20 mm and the thickness is 7 mm. There are nine main denticulations, with smaller cut marks within them. As on 31819, several cut marks extend beyond the denticulations towards the middle of the piece indicating slippage.

On the face from which notches were cut, several deep striations run parallel to the edge and the fine striations are concentrated in the middle of the piece. On the reverse face the striations run from the middle to the end of the piece and there is another set of striations that start at a denticulation and run horizontally.

27069

This is a burnt fragment of scapula or rib with denticulations cut along one edge (Singer & Wymer 1982:115: fig 8.1). The piece (Fig. 37c) is 27 mm long, 31 mm wide and 6 mm thick and was recovered from the interface between SASW (Layer 15, west cutting) and SASR (Layer 14) in cave 1. The notches were cut from one face and run along an edge that terminates in breaks. They are usually formed by more than one incision and the spacing of the sets of incisions is approximately 1 mm (19 along a length of 16 mm). In addition to the serration of the edge there are numerous striations on both surfaces. Some are V-shaped 'double scars' apparently made by a stone tool, running at an angle of 30 degrees to the worked edge. There are other striations that are parallel to the edge but most are in localised areas.

SASW H1

There is one bone artefact (Fig. 37d) from the witness baulk in cave 1, SASW sub-member, unit H1. It is on a fragment of a shaft bone and is 41 mm in length, 23 mm in maximum width. It tapers to an asymmetrical short point. The outer cortex of the bone has been removed. The tip of the point shows polish consistent with use as an awl.

26733

This is a small burnt fragment of shaft bone with what appear to be scratched lines from Layer 20 in cave 1A (Singer & Wymer 1982:115). It is doubtful whether the marks are intentional. The piece is uninformative.

42160

A bone point was found in Layer 19 in cave 1A at the base of the Howiesons Poort. Singer & Wymer (1982:115) have described this find in detail. They suggest that it could have served as a pin or awl, but that such thin bone points are generally interpreted as arrowheads. It is a slender tool (Fig. 37e) that would not be out of place in a Later Stone Age context. However, there is no reason to doubt its association with the Middle Stone Age. Similar bone points have since been reported from Blombos Cave (Henshilwood & Sealy 1997) lending support to the acceptance of the presence of formal bone tools in the Middle Stone Age.

Discussion

It is significant for arguments about symbolic behaviour that ochre is present throughout the sequence even though it may increase towards the top (Watts 1996). Ochre, as a commodity and a colour symbol, had significance for groups living at main site, some 115 000 years ago.

Pieces of ochre have been ground and it is noteworthy that several of the so-called crayons are sub-triangular in shape. This shape appears too regular to be a product of use

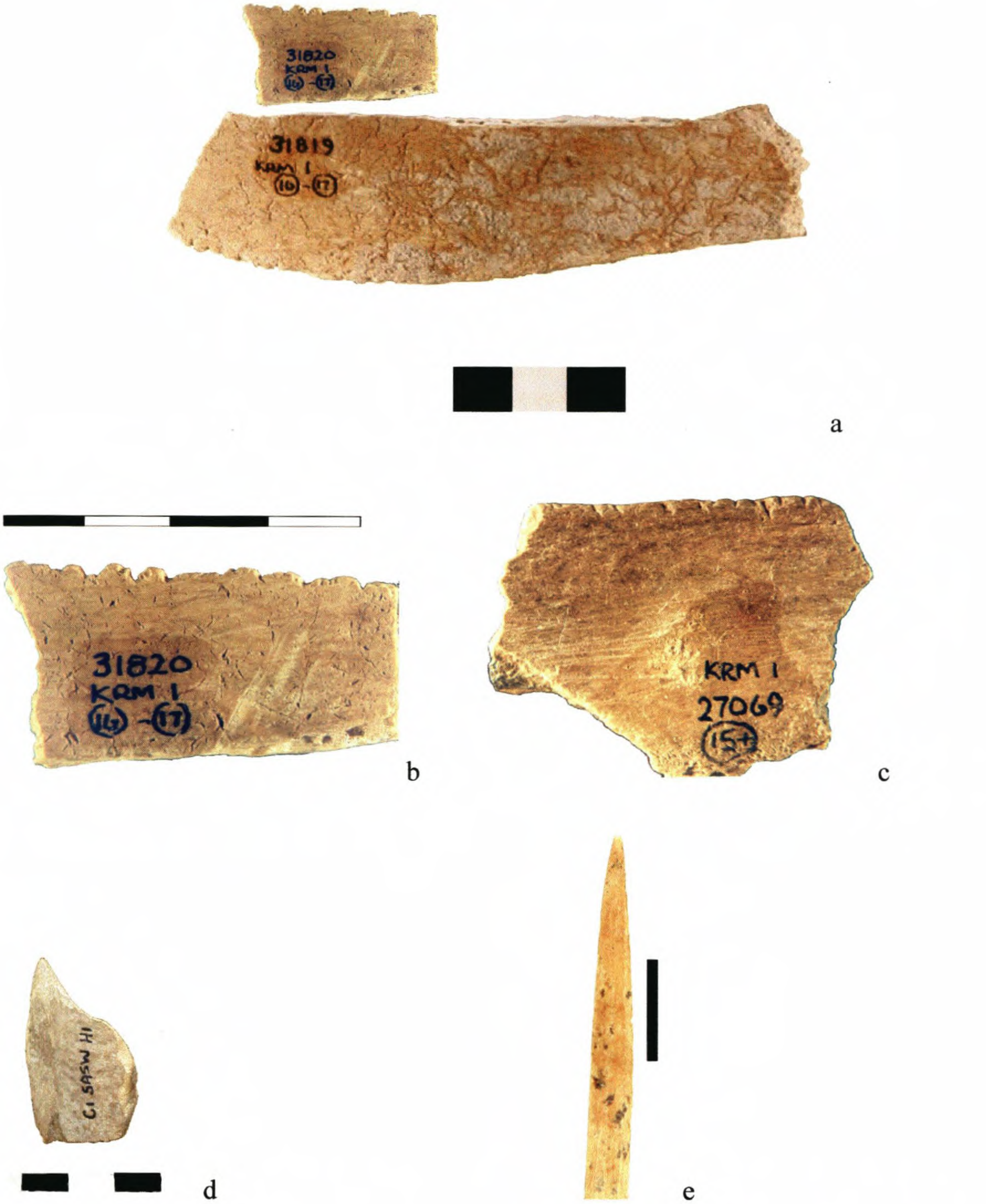


Figure 37 a) Two pieces of edged notched rib bones (SW-sample); b) Detail of notching on 31820; c) Edge notched bone, cave 1, scale as on b); d) Bone point, witness baulk; e) Bone point (42160).

and may have been an imposed form in the same sense as a type. The sub-triangular form may represent the complete artefact, a unit of ochre as opposed to a broken fragment. A unitary value only makes sense if it was a convention to transport ochre in this form, or if ochre was traded. There is a further indication of trading in ochre. The piece (Fig. 36b) with holes is matched by several pieces from the Still Bay occurrence at Blombos Cave, some 250 km distant (Henshilwood & Sealy 1998). It must be considered improbable that there is more than one outcrop of ochreous Bokkeveld mudstone with the trace fossils of the same organism. A single source is indicated. As there are more pieces in the small sample from Blombos Cave, the source is probably closer to the latter. Mining (Beaumont 1973) and trading in ochre in ochre in the Middle Stone Age would indicate the operation of reciprocal exchange networks. If networks existed, they would have involved not only ochre but also other raw materials and possibly artefacts. The trading in commodities with values established by arbitrary convention would constitute symbolic behaviour. This is the kind of evidence to be sought in the archaeological record of the Late Pleistocene.

There is a natural reluctance to give undue weight to rare archaeological finds from unexpectedly old contexts. This applies to the bone tools from main site. The purposeful and regular denticulation warrants a description as a convention through the imposition of form. It is in this sense rather than in the sense of decoration that these pieces should be interpreted. They would evidence symbolic communication. Although these denticulated pieces are in the same style, they come from apparently different layers, Layer 36 in cave 1A and the disturbed top of Layer 15 in cave 1. However, the stratigraphic positions may be identical. As argued in Chapter 2 in respect of the human remains, the position in what has been described as the disturbed top of Layer 15 more probably relates to Layer 16, and this position would correlate with Layer 36.

The short bone point from the SASW in the witness baulk would relate stratigraphically to the upper part of the SAS in cave 1A. It would be somewhat older than the bone point recovered from the base of the Howiesons Poort layers. Bone tools are significant in arguments of symbolic behaviour in as far as they represent the imposition of form. There is no significance *per se* in producing tools in bone.

CHAPTER SEVEN

OUT-OF-AFRICA AND THE ROOTS FOR MODERN BEHAVIOUR

Out-of-Africa

One of the major issues in palaeoanthropology, is the emergence of modern humans. There are two main hypotheses to explain how anatomically modern humans populated the Old World, the single origin model and the multiple regional models (Foley & Lahr 1997). The single origin model proposes that all living people come from a founder population that lived about 150 000 years ago in Africa. They dispersed from Africa and replaced archaic hominid populations elsewhere. The multiregional model claims that *Homo erectus*, who at about 1.8 million years ago dispersed throughout the Old World from Africa, was the direct ancestor of modern humans. The latter model has been criticised on empirical grounds because it relies only on an interpretation of the fossil evidence, and on theoretical grounds (Harpending & Relethford 1997) because it is improbable that gene-flow over a vast area for more than a million years could have maintained species integrity. The single origin model enjoys wider support because it is better substantiated. It is supported by genetic evidence (Cann *et al.* 1987; Stoneking 1993; Foley & Lahr 1997) and by fossil evidence (Stringer & McKie 1996). The Klasies River main site (Singer & Wymer 1982; Deacon, H.J. 1989) is one of a handful of sites in Africa that provide fossil evidence in support of the single origin model. There are a number of variants on the single origin hypothesis (Lahr 1996; Ambrose 1998a) because of differences in the weight given to certain data.

One of the most controversial issues in the debate on modern human origins is the behaviour of the earliest modern humans. Fossil and genetic evidence provides scant information on behaviour and the most important source is archaeology. Both the multiregional and single origin models claim that archaeological data support their positions. The multiregional model stresses continuities in the archaeological record as between the Middle and Upper Palaeolithic. The model makes no testable predictions and, whatever the archaeological record shows, fits the model. It is not discussed further.

The single origin or Out-of-Africa model makes the prediction that people who were anatomically and behaviourally modern moved out of Africa. This prediction is testable because there should be evidence in African sites for physical and behavioural modernity that is older than in Eurasia. Adherents to the model accept that populations in Africa were anatomically modern more than 100 000 years ago. What is debated is when modern behaviour emerged.

There are two schools of thought in the modern behaviour debate. One, labelled the later modern behaviour (LMB) hypothesis, is that a modern capacity for culture developed after the dispersal of modern humans within Africa and that it was this capacity that allowed the later migration to Eurasia. The migration resulted in the replacement of the Middle Palaeolithic Neanderthals by Upper Palaeolithic modern humans. As the Middle to Upper Palaeolithic transition is dated to some 40 000 years ago, the capacity for modern behaviour would be evident somewhat earlier in Africa (Klein 1995; Ambrose 1998a). This school attempts to link the Out-of-Africa model to the conventional thinking that the Middle to Upper Palaeolithic transition marks the beginnings of a symbolic revolution (Mellars 1991). The second school of thought holds that the evolution of modern humans in Africa is directly linked to the emergence of modern behaviour and that modern behaviour is evident in the archaeological record in Africa and possibly elsewhere prior to 100 000 years ago (Deacon, H.J. 1988, *in press*; Wurz 1999). This, the earlier modern behaviour (EMB) hypothesis, discounts the primacy of the evidence of the Upper Palaeolithic symbolic revolution for the emergence of modern behaviour. It sees the Upper Palaeolithic as a regional phenomenon reflecting a particular demographic situation and intensification of the use of resources. Rather, the concern is with the archaeological evidence for the emergence of symbolic communication in regions like Africa that lay outside the compass of the Upper Palaeolithic.

This dissertation is a critique of the LMB hypothesis and an argument aimed at the development of the EMB hypothesis. The contention is that the emergence of a capacity for symbolic communication as defined in Chapter 3 was a biocultural evolutionary process that involved the reorganisation of the brain. In seeking an explanation for the origins of modern behaviour, the archaeological evidence cannot be divorced from that available for the evolution of the brain. Evaluating the merits of these two competing hypotheses depends not only on empirical evidence, but also on finding more fossils or artefacts from better dated contexts. The evaluation has to be grounded in theory drawn from different disciplines as noted in Chapter 3.

The later modern behaviour (LMB) model

It is generally accepted that the 'cultural explosion' or 'cultural revolution' evidenced in the Upper Palaeolithic indicated an ability to communicate symbolically (White 1982; Chase & Dibble 1987; Binford 1989; Davidson & Noble 1989, 1998; Ambrose 1994, 1998 a, b; Klein 1989, 1992, 1995, 1998; Whallon 1989; Mellars 1989, 1991; Stringer & Gamble 1993; Byers 1994, 1999; Mithen 1996; Noble & Davidson 1993, 1996). The creative florit, beginning some 40 000 years ago in Western Europe, is impressive evidence for a social life, rich in symbolism. This is expressed in art and ornamentation, in the making of bone, shell and ivory artefacts, in the practice of elaborate burials, in the typological standardisation and variety of stone tools, in the construction of 'long houses', At question is whether this is the oldest acceptable archaeological evidence for the emergence of modern behaviour. It can also be questioned whether these behaviours were context specific or whether they can be accepted as universal markers of symbolic communication.

The notion of what constitutes modern behaviour has hardly changed since the early 1900s. For example, in 1924 Elliot Smith (Landau 1991:131) linked the Upper Palaeolithic achievements to Neoanthropic Man:

"... a whole series of other industries of the Upper Palaeolithic, new methods of stone work, modelling, painting and other kinds of artistic work, revealing the modern spirit of Man ... thus the new spirit of Man and modern Man himself are revealed in the Upper Palaeolithic Period".

Elliot Smith and later researchers have stressed that the innovation and creativity, evidenced in the Upper Palaeolithic, sets this period apart from the Middle Palaeolithic. Innovation and creativity are seen as a reflection of the same ability that allowed people to invent or discover language. The importance that has been attached to creativity and innovation is a residue of the Enlightenment philosophy that emphasised faith in progress and promoted acceptance that moral and social progress was the concomitant of technological development (Trigger 1989).

There is no theory that guides the selection of criteria or markers that reveal 'the new spirit of Man' in the archaeological record. However, Noble & Davidson (1996) and Byers (1999) and Chase (1991) provide well-founded criteria for the recognition of symbolic communication. As discussed in Chapter 3, the common thread in their arguments is that fluctuating arbitrary conventions can be equated with modern as opposed to non-modern-type symbolic behaviour. This is the standard for the recognition of symbolic behaviour in all humankind. However, not all kinds of conventionalised arbitrary behaviours are general enough to use as markers for interpretation of the archaeological record. Cross-cultural studies show that the symbolic mode of thought can be expressed in an indefinitely large number of alternative ways (Leach 1973:767) that can be placed on a continuum from idiosyncratic to cross-cultural regularities (Von Gernet 1993:77). From an archaeological perspective, it is the higher level regularities that transcend spatial and temporal boundaries that may be more acceptable as markers for a modern symbolic behaviour.

Simple comparisons, between what people in the Upper Palaeolithic did and people in the Middle Palaeolithic did not do, has provided the long list of markers for modern symbolic behaviour, given at the beginning of this section. Some of the markers seen in the Upper Palaeolithic such as art, ornamentation, typological variety and standardisation of artefacts and raw material variability are acceptable evidence for symbolic behaviour as they meet the standard of arbitrary conventionality. However, in themselves, they may be context specific and an indication of how modern humans behaved there and then and thus fall in the class of idiosyncratic behaviour. The point is made that they are not necessarily universal markers. The other markers listed have little or no relevance for assessing symbolic capabilities.

The strongest evidence for symbolic capabilities is considered to be the presence of 'art' (Davidson & Noble 1989; Chase 1991; Mithen 1996; Noble & Davidson 1996, but see Soffer & Conkey 1997). Art, a potentially contentious term when used for prehistoric materials, would include categories such as imagery, ornamentation and decorative items like beads, pendants and perforated animal teeth. The view that 'art' is central to understanding the origin of symbolic communication is regarded with scepticism by some (Chase 1993; Deregowski 1993; Schepartz 1993; Soffer & Conkey 1997) and deservedly so. Apart from the fact that art may not preserve well, there are several reasons why art is not central in expressing symbolic communication. The apparent explosion in art, ornamentation and decoration that is recorded in the Upper Palaeolithic in Europe, and perhaps in Australia, is a regional phenomenon. There was no evidence for a similar florescence elsewhere in the world at that time. For example, prehistoric depictions and ornamentation occur rarely before the Holocene in the South African archaeological record and it is only in the Holocene that they are found in any notable frequency (Deacon & Deacon 1999). There is no universal mode of expression of symbolism through 'art' among ethnographically known populations that suggests it would be always visible to the archaeologist. An apparent absence of evidence for 'art' is not an indication that people did not have the ability to behave in modern ways. The same argument can be made in respect of the variable rituals associated with burials.

The manufacture of artefacts in bone, ivory and shell, materials widely used in the Upper Palaeolithic, has been given significance in arguments about the identification of modern behaviour (Klein 1995; Mithen 1996; Noble & Davidson 1996; Davidson & Noble 1998). These materials were seldom if ever used in the Middle Palaeolithic. Their use in the Upper Palaeolithic is seen as an indicator of symbolic behaviour because they evidence innovation. The use of bone for artefacts is hardly an innovation because either the paranthropines or early *Homo* or both crossed this threshold more than a million years ago (Brain & Shipman 1993). Rare finds of wooden artefacts suggest they have a history of use, long predating the Upper Palaeolithic, and are almost never archaeologically visible. If the manufacture of artefacts, in materials like bone, is accepted as a universal marker for symbolism because such artefacts occur in the Upper Palaeolithic, then their presence or absence becomes a criterion for interpreting the archaeological record elsewhere. This explains significance given the occurrences of bone artefacts in Middle Stone Age contexts reported from southern and eastern Africa (Singer & Wymer 1982; Brooks *et al. 1995;* Knight *et al.* 1995; Yellen *et al.* 1995; Henshilwood & Sealy 1997).

The occurrences are rare or local and the contexts and dating are not always well established. Each occurrence has to be evaluated in terms of its significance for symbolism. Bone, ivory from mammoths and antler from reindeer would have been natural materials to use for artefacts in the park tundra environments of the Upper Palaeolithic. In the African environments wood was the usual non-lithic material to use.

Specialised hunting techniques are a further example of a marker often cited for modern behaviour (Klein 1995, Noble & Davidson 1996, Mithen 1996). Klein (1995, 1999) has argued that because Middle Stone Age people did not hunt dangerous animals, flying birds or fish, they did not have the ability to perform such tasks. However, it is evident that Middle Stone Age people at Klasies River main site and at other Middle Stone Age sites such as Die Kelders, hunted bovids of all sizes, both dangerous and not dangerous (Milo 1998; Marean 1998). Fish bones do occur in coastal sites but it still has to be demonstrated that such finds imply fishing as an activity. Irrespective of this, hunting, fishing and fowling are economic activities and in themselves cannot be seen to be indicators of cognitive abilities. Subsistence behaviour is determined by what is available, what is preferentially ranked and obtainable at an acceptable cost in effort. Economic behaviour at this level is not relevant to whether or not people could communicate in symbols.

The earlier modern behaviour (EMB) model

The archaeological evidence that is the most common and best preserved and therefore has the most potential for the recognition of symbolic behaviour, is the presence of discrete artefact types and typological variety in time and space (Byers 1994; Noble & Davidson 1996). As argued in Chapter 3, the concept of type can be extended to include technological reduction sequences as a category. Typological variety in the Upper Palaeolithic, for example, is significant because it is evidence of overdetermination of form in societies in which artefacts fulfil a warranting role. Such evidence is available from the Late Pleistocene, Middle Stone Age.

Types occur in the Middle Stone Age. For example, the standardised backed artefacts in the Howiesons Poort (Deacon, H.J. 1989; Wurz 1999) are recognised as a type in the same sense as in the Upper Palaeolithic (Mellars 1991; Davidson & Noble 1993). There are other types of retouched artefacts, like leaf shaped and hollow based points, in the Middle Stone Age and the backed artefacts are not unique. These types occur in horizons as much as twice the age of the earliest occurrences of types in the Upper Palaeolithic.

It has been suggested that because the Howiesons Poort backed artefacts are not succeeded in the sequence by another retouched morphotype, their value as a marker for modern behaviour is tenuous if not negated (Thackeray 1989; Clark A.M.B. 1999). However, the serrated knives in the overlying MSA lll are an equally valid type, so this contention can be discounted. It has also been suggested (Thackeray 1989:53) that the Howiesons Poort backed artefacts are more variable than backed artefacts in the Later Stone Age, but it has been demonstrated (Wurz 1999) that, in terms of coefficient of variation, they are not more variable, just larger. A.M.B. Clark (1999) reasons that the Howiesons Poort is not evidence of time-restricted patterning because she accepts the postulate of Parkington (1990) that Howiesons Poort type artefacts occur between 70 000 and 19 000 years ago. There are not adequate grounds for accepting this chronology (Deacon, H.J. 1992; Wurz 1999) and the occurrence of Howiesons Poort artefacts is a temporaly restricted horizon marker in sequences throughout southern Africa. Noble & Davidson (1996:174) accept the early dating of the Howiesons Poort, but cannot accept that the backed artefacts signify symbolic behaviour because they contend that language evolved more recently. In the same vein, Klein (1995) claims that people in the Middle Stone Age did not have the capacity for modern behaviour because modern minds had not yet evolved. Other attempts at explaining away the early occurrence of types in the Middle Stone Age invoke concepts like 'simple aesthetic appreciation' or see these types as an elementary measure of symbolic expression that was a precursor of what emerged on a greatly increased scale in the Upper Palaeolithic (Mellars 1996). None of these objections to accepting the occurrence of valid types in the Middle Stone Age stand scrutiny.

Part of appreciating the concept of types in the Middle Stone Age is its extension to include the standardised and formalised core reduction sequences advocated here. The volatile ways in which types and reduction sequences change is explicable by Byers' style 2. Changing ideals guided the production of artefacts. The switches in reduction strategies and changes in types can be regarded as arbitrary and be linked to societal practices.

In arguing that the evidence from main site supports the emergence of modern behaviour prior to 115 000 years ago, H.J. Deacon (1989, 1992, 1995, *in press*) has drawn comparisons between the behaviours in the Late Pleistocene, in the Later Stone Age and among traditional San hunter-gatherers. He argues that no difference in the behavioural abilities is indicated and accepts that early modern humans were modern in behaviour. He has cited the presence of the reciprocal exchange of backed artefacts made in exotic raw materials and ochre as evidence of symbolism in the Middle Stone Age.

The proposition that the backed artefacts made in exotic materials are evidence of reciprocal exchange, is plausible in the light of ethnographic examples, but it is a high level inference that cannot be evaluated under the theory used in this dissertation. Ambrose & Lorenz (1990) regard the use of exotic raw material as related to increased territorial networks due to environmental forcing and mobility, and not to symbolic abilities. However, networking itself implies symbolic communication. There are relatively subtle environmental changes evident in the main site sequence but as environment affects population distributions and densities and not human behaviours directly, any deterministic or functional explanation for raw material changes can be discounted. There is no convincing evidence for a change in the subsistence base at main site (Klein 1976; Voigt 1982; Milo 1994) that would support a causal explanation for either a change in artefact designs or raw material usage. For this reason, it can be argued that changing preferences for raw materials through time have no functional relevance and are evidence for style 2, or symbolic behaviour.

Ochre is commonly cited as evidence for symbolism (Beaumont 1973; Deacon, H.J. 1989; 1995; Knight *et al.* 1995; Watts 1996). These authors accept that ochre has been used as a colouring agent. H.J. Deacon regards ochre as indicating a capacity to communicate by the use of symbols because of the strong ethnographic evidence for the symbolic meaning of the colour red. Ochre occurs throughout the main site sequence and some pieces recovered have ground facets and striations showing that the material was powdered. This means it was applied possibly to the body or apparel to be visible. The use of ochre is symbolic because the meaning of its use has to be communicated. Even though preservation may be adversely affected in some parts of the deposit, there is an apparent increase in the Howiesons Poort levels relative to the frequency in the underlying strata. This may identify the Howiesons Poort levels as accumulating during a period of heightened symbolic communication.

Two of the markers, the use of non-local raw materials and ochre, discussed here fulfil the three criteria of symbolic communication, arbitrary conventionality, changing conventionality, and universal expression. Additional evidence comes from the occurrence of artefact types and reductions sequences discussed in Chapter 5. There are few archaeological materials that qualify as markers for symbolic behaviour under these stringent criteria. If the criteria can be satisfied in one class of evidence, it means a web of symbolism structured living in the relevant society. The reason, as discussed in the next section, is because behaviour is linked to biological evolution.

Brain evolution and modern behaviour

The emergence of symbolic communication has been associated with the evolution of the brain (Aiello & Dunbar 1993; Donald 1991, 1993; Dunbar 1993; Klein 1995; Mithen 1996). The neural hypothesis proposed by Klein (1995) states that it was a reorganisation of the brain at some 40 000 years ago that enabled people to think and act symbolically. Another suggestion made by Davidson & Noble (1996) is that parts of the brain that were developed by aimed throwing (Calvin 1983, 1991) were exapted to enable people to use language. Mithen (1996) argues that it was through the development of interconnections between modules of the brain that made thinking in cognitively fluid ways possible. These three influential hypotheses are not grounded in neural evolutionary accounts (Greenberg *et al.* 1999; Sherratt 1999). They rest on the premise that it was the sudden change in the brain, mirroring the abrupt Middle to Upper Palaeolithic transition, which allowed people to symbol. A discussion of how brains evolve and how this evolution can be traced in the human fossil record is necessary to show that this premise is untenable.

The human brain is unique in the animal world because it has been reorganised to accommodate symbolic thinking and speech. Speech is likely to be the consequence rather than the cause, or part of the cause of the evolution of symbolic thinking (*contra* Milo & Quiatt 1993:577). Enhanced vocal articulatory ability would have minor adaptive value if it had not been coupled to symbolic abilities (Deacon, T.W. 1997b). Thus, speech is used for the expression of symbolic thought. In human speech, phonemes (units of sound) are produced at a rate of over ten per second in a single exhalation. This is made possible by manipulation of the vocal tract, muscle movement of the tongue, lips and jaw and control of breathing, which is under control of the brain. Comparisons with the brains of other species provide clues to the nature of reorganisation that the human brain has undergone The comparisons show that the brain has evolved and reorganised to the extent that these aspects of speech can be controlled voluntarily. Brain reorganisation cannot be observed directly in fossil or archaeological evidence. Brain size, the supralaryngeal tract and expanded thoracic vertebral canal are indicators of symbolic thinking and speech, that can be studied directly.

A bigger brain is often assumed to be related to more computing power, and hence greater intelligence. However, a bigger brain, as such, does not indicate symbolic abilities (Holloway 1995; Deacon, T.W. 1997a). However, it is an indirect indicator that reorganisation has taken place. Brain enlargement is inevitably accompanied by reorganisation because more dendrites are necessary to connect the parts of a larger brain (Deacon, T.W. 1988, 1997a,b; Kien 1991). In the process of enlargement, natural selection operates to favour a different organisation, because it becomes impossible to connect all brain areas and to maintain brain function

Human brains are not simply larger than the brains of other species. They have anomalously large prefrontal cortices (Uylings & van Eden 1990; Deacon, T.W.W 1988, 1997a,b; Schoeneman & Wang 1996; Greenfield 1997; Rilling & Insel 1999; but see Semendeferi *et al.* 1997). The prefrontal cortex has increased out of proportion to the basal and sub-cortical forebrain structures (basal ganglia, thalamus, hypothalamus). The cerebral cortex of the forebrain is almost twice as big as predicted for other forebrain structures, and three times as big as predicted for the brain stem and spinal cord (Deacon, T.W. 1997a:184). As a result of this enlargement, more connections are made through the prefrontal cortex to other areas of the brain (Deacon, T.W. 1997a:256).

Terrence Deacon (1988, 1997a) has put forward a hypothesis that relates the large prefrontal cortex and resultant differential organisation of the brain to an ability to understand symbolic communication. The prefrontal cortex supports symbolic communication through a distributed mnemonic (memory-aided) architecture and not in the storage or retrieval of symbols. Electrical stimulation of the brain and metabolic imaging methods such as rCBF, PET and fMRI, indicate that the synapses in the prefrontal cortex are dominant in the connections with other brain regions in language functions (Deacon T. 1997a:257). The way in which the prefrontal cortex supports a symbolic mnemonic strategy, is by inhibiting the tendency to act on simple correlative stimulus relationships and by guiding higher-order hierarchical associations (Deacon, T.W. 1997a:264). Despite considerable fundamental neuroscientific research, there is much more to be learned about the specific way in which the human brain assists in structuring learning and memory strategies (Kosslyn & Anderson 1992; Sacks 1997). However, Terence Deacon's hypothesis is important in indicating how the brain relates to symbolic behaviour.

The measure of the enlargement of the brain is the encephalisation quotient (EQ). This refers to the allometric relationship of the brain to body size or brain to body mass ratios. Calculation of EQ for fossil hominids is complex. Body mass has to be inferred from particular measurements such as long bones or the orbital area and the results have to be interpreted and variance has to be smoothed by using logarithmic transformations (Aiello 1992; Greenberg *et al.* 1999). Despite these difficulties, there is good evidence in the fossil record that there has been an absolute increase in brain size in the evolution of *Homo.* Compared to primates with an EQ larger than one, for example, chimpanzees have an EQ value of 2.4, humans have an EQ value of about 7 (Foley 1995).

Some authorities (Deacon, T.W. 1997a:344) see a gradual, incremental increase in relative brain size in the evolution of *Homo,* from about 750 cc for the habilines to between 800 and 1000 cc for *Homo erectus.* The values for modern humans are about

1350 cc. Others (Groves 1989; Aiello 1996) describe the increase as punctuated. The first spurt of brain enlargement in the lineage may have occurred prior to 1,8 million years ago and been associated with the habilines. Wood & Collard (1999), however, regard the values for *H. habilis* and *H. rudolfensis* to be in the same range as that of *Australopithecus africanus*. This would suggest a stasis in brain enlargement between 3,0 and 1,8 million years. Any increase in brain size at 1,8 million years and associated with H. *ergaster/H. erectus* (McHenry 1992) may be related to an increase in body size. It would seem then that the most significant absolute increase in encephalisation only occurred after the beginning of the Middle Pleistocene (Ruff *et al.* 1997). Rightmire (1998) suggests that mid-Pleistocene fossils which date to between 600 000 and 300 000 years ago such as Bodo, Kabwe, Petralona, Arago and Dali have absolute and relative brain sizes larger than those of H. *erectus*. Aiello (1996) dates this spurt in brain enlargement somewhat later at about 250 000 years ago but, since that publication appeared, the dates for the relevant fossils have been revised. None of the fossil specimens dating from the last 200 000 years has a cranial capacity less than 1200 cc (Groves 1989:302) and, by this time, brain size had reached the modern range. Taking into account recent age estimates for archaic *H. sapiens* (Bräuer *et al.*1997), between 600 000 and 200 000 years ago and possibly close to 300 000 years ago, the reorganisation of the brain would have been completed. This would have enabled symbolic communication as suggested by Terrence Deacon.

Other evidence for reorganisation of the brain comes from the size of the thoracic vertebrate channel. The thoracic vertebrate channel contains the motor neurons that control the intercostal muscles and other trunk muscles involved in controlled breathing (Maclarnon & Hewitt 1999). In early modern humans and the Neanderthals, this area has evolved to modern proportions, indicating increased innervation to the muscles related to speech. Control over the intercostal muscles and abdominal muscles is essential for the sophisticated breathing control that is essential for rapidly phonemisized speech as we know it.

It is not the only the size of the thoracic vertebral channel that is important. The nerve cells that control breathing are under voluntary control. The ability is unique to humans and the enlargement of the cortex can explain it. The outer part of the cortex is enlarged and more neurons in the outer cortex are available to connect to output motor neurons in brain stem and the spinal cord of the inner brain. It is direct input-output relationship between neurons that controls the breathing system. As a result the muscles controlling breathing and movements of the tongue, lips and jaw have come under voluntary control (Deacon, T.W. 1997:250). Other primates do not have this ability. In primates, the movement in breathing and of the tongue, lips and jaw, are controlled automatically from the inner brain structures because there are no direct input-output neurons connecting the outer brain to the inner brain. It is the ability to co-ordinate breathing with movement of the laryngeal system that allows humans to speak.

A more controversial indicator that speech is under direct neural control, is the form of a modern supralaryngeal tract. In modern humans, a descended larynx gives the ability to modify vocal sounds. In evolutionary terms this is an expensive and unusual option, as humans can easily choke because the respiratory and digestive tubes overlap. A modern supralaryngeal tract would reduce fitness, unless the neural mechanisms that regulate the voluntary articulatory control of human speech were present (Lieberman 1989; Lieberman *et al.* 1992). There are divergent opinions on when the modern vocal tract is evident (Lieberman & Crelin 1971; Lieberman 1984; Laitmain 1985; Laitman *et al.* 1993; Schepartz 1993; Arensburg *et. al.* 1990; Lieberman & McCarthy 1999), but most agree that archaic humans and early anatomically modern humans in Africa had a modern vocal tract.

Endocasts have not proved to be useful indicators of speech and neural reorganisation. Supposed 'language areas' such as Broca's area and Wernicke's area have been identified in endocasts (Tobias 1979, 1998; Falk 1987; Mithen 1996). Damage to Broca's area results in aphasia (loss of speech) while damage to Wernicke's area affects the ability to understand language or speech. The inferences drawn from the study of these areas in endocasts have come under increasing criticism (Holloway 1983; Gannon and Laitman 1993). Broca's area is found in species other than humans (Müller 1996). Recently, Gannon *et al.* (1998) have reported that an asymmetry of the Planum Temporale, a site within Wernicke's posterior language area, is present in chimpanzees, and in some cases to a greater degree than in humans. Further, the prominence of certain areas in endocasts is not necessarily related to those parts of the brain being larger. It has more to do with the general increase in cranial capacity than with the functions performed by those areas. No part of the brain relates to a single function and controls language or any other dimension of behaviour (Davidson & Noble 1996:16; Deacon T.W. 1997a:286). This is the shortcoming in arguments stressing the importance of Broca's or Wernicke's areas in the evolution of the brain and speech.

Species specific characters in *Homo sapiens* that are related to speech, a larger brain, a modern supralaryngeal tract and breathing mechanisms, can be associated with the earliest modern human fossils. The physical changes that took place to accommodate speech are an indication that the restructuring of the brain, in particular the prefrontal cortex, had been completed some 300 000 years ago. In the light of this biological evidence, any assumption that the development of speech was related to the 'symbolic explosion' in the Upper Palaeolithic some 40 000 years ago is untenable. Discounting discredited evolutionary mechanisms such as the "magic mutation" and "hopeful monsters" enabling new behaviours (Deacon, T.W. 1997a; Szathmáry 1999:745), the scenario that a sudden neural mutation (Klein 1995), a flick of the switch (Stringer & Gamble 1993), triggered the symbolic explosion does not allow time for the operation of normal evolutionary processes. An alternative scenario for the emergence of modern behaviour that accords with the archaeology and current knowledge of brain evolution is offered below.

The evolution of the capacity for modern behaviour

The neural substrate necessary to communicate symbolically is part of species-specific predispositions that have evolved over a considerable period of time. One such characteristic is a large prefrontal cortex and another is the voluntary control of speech organs through prespecified neural maps. This component of brain development is controlled by regulatory genes (Edelman 1992). However, brains do not function because of innate connections. For the networks of neurons to function properly, fine-tuning has to take place to strengthen the connections. Input from the environment is so integral to brain function that brains have been described as bio-environmental or bio-social organs (Gibson 1996; Müller 1996; Greenberg *et al.* 1999). This has provided the opportunity for natural selection to act on variation.

In organisms with flexible behaviour like the higher primates, behaviour plays a substantial role in driving the genetic and physical changes. The process of Baldwinian evolution (Deacon, T.W. 1997) explains how behaviour is crucial in driving genetic change. The Baldwin effect refers to the tendency of organisms that acquired useful adaptations through learning to be successful. This leads to a higher probability of their successful reproduction and the subsequent fixation of the adaptation.

The kinds of behaviour that can drive genetic change have to meet certain conditions. Such behaviours must last for thousands of generations, should be largely invariant and should contribute to reproductive success (Deacon, T.W. 1997; Boone & Smith 1998:143). Fixation is when the predisposition of a behaviour has become part of the genetic code. An indication that such fixation has occurred is when learning and thus culture transmission cannot be performed without the trait (Ames 1996:113). Symbolic language (spoken or not) is crucial for cultural transmission in humans. In modern humans symbolic communication has been so successful, that the cognitive basis for its expression has become fixed. Fixation could not have occurred suddenly as in a 'symbolic explosion' but would have taken upwards of a 100 000 years to be completed.

Brain reorganisation was a response to the selection pressure created by the first symbolic reference. The neural symbolic threshold became easier to cross with time and modern language evolved incrementally from simpler beginnings. What have become internalised in the genes are the kinds of neural connections that can support a symbolic mnemonic system, and the connections that allow speech to be controlled consciously.

Information from neurological evolution and palaeoanthropology can be used to show that the Upper Palaeolithic is an epiphenomenon that is best explained as an intensification of symbolic behaviour. Eurocentric concerns with the Upper Palaeolithic in attempting to explain the emergence of modern behaviour have not been productive in model building.

Discussion

The Out-of-Africa model has given new impetus to the study of modern human origins. It has meant that the archaeology of all regions of the globe is relevant to the emergence and dispersal of modern humans. The traditional scenario that modern humans evolved in the Near East and migrated into Europe equipped with Upper Palaeolithic technologies has become untenable as research in the parts of the Old and New Worlds has advanced (Foley & Lahr 1997). Cognisance need to be taken of the archaeology of Africa as the probable centre of evolution of modern humans in building more robust scenarios.

The debate about the timing of the emergence of modern behaviour whether 'later', *circa* 60 000 – 40 000 years ago or 'earlier', prior to 100 000 years ago is not so much new as not well publicised. However, it is an important debate because it focuses on the archaeological record and evolutionary mechanisms. The LMB hypothesis lays emphasis on the phenomenon of the so-called 'symbolic explosion' and correlates this to an abrupt neural event (Klein 1995). The hypothesis rest almost entirely on empirical archaeological and palaeontological observations. It has no theoretical support in evolutionary studies of the brain.

The EMB hypothesis is more in accord with the archaeological and evolutionary evidence. This hypothesis couples the evolution of modern human behaviour to the biological evolution of modern humans. It pushes back the transition between archaic and modern humans to before 100 000 years ago. Its strength is that it allows sufficient time for the fixation of the neural predispositions for symbolic behaviour. The scenario that is suggested by the EMB hypothesis is illustrated in a diagram (Fig. 38).

Fig. 38 indicates that brain enlargement, caused by changes in the regulatory genes, probably accompanied by changes in life history (Hill 1993), would have been necessary for neural restructuring. The process of restructuring of the brain would have progressed over an extended period in tandem with the development of symbolic communication. This would have entailed evolution from a proto-language to language as we know it. A long period after the initiation of enlargement of the brain and its completion would have

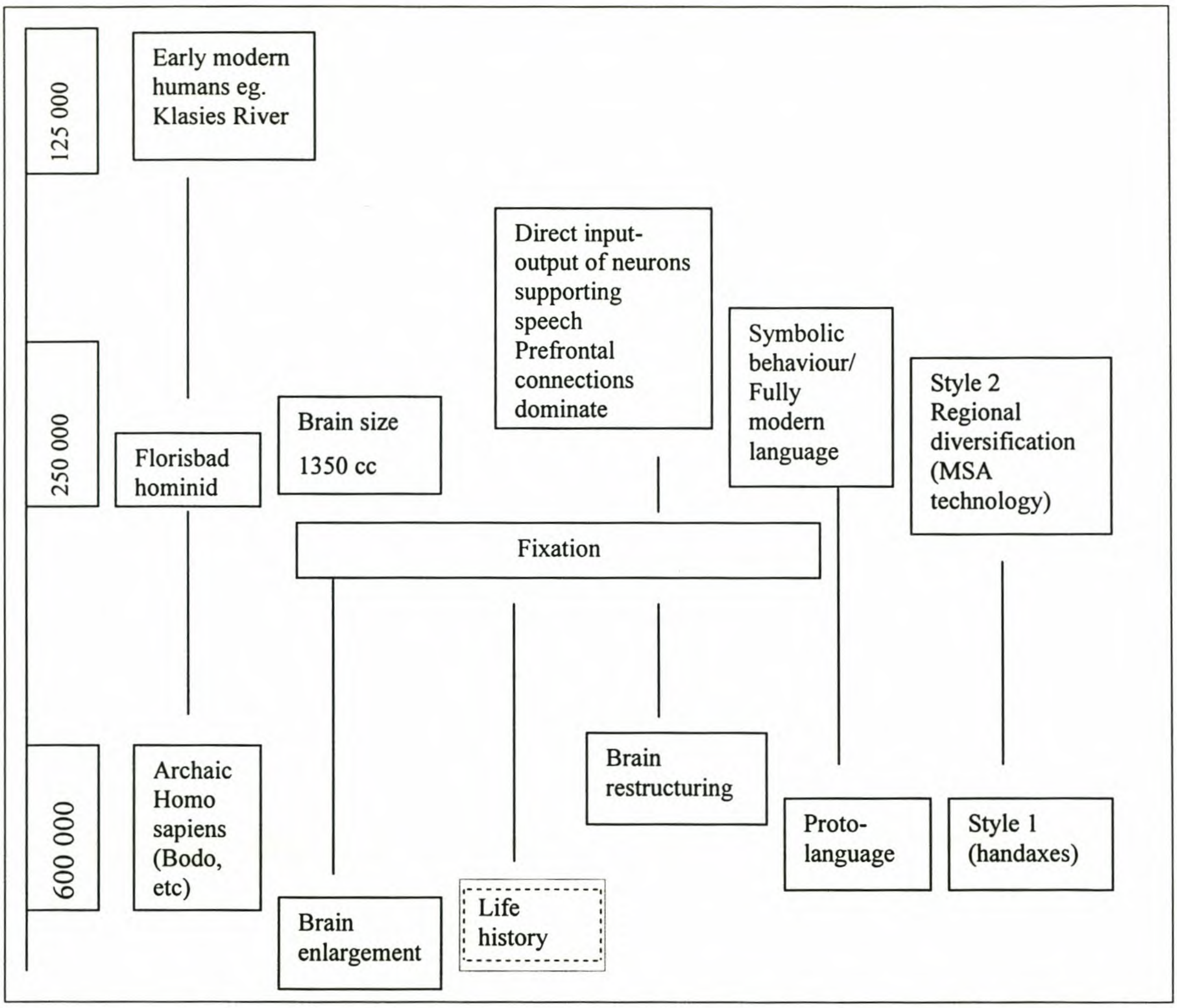


Figure 38. A diagram showing the evolution of symbolic behaviour in the last 600 000 years.

been necessary for fixation of the neural predispositions for fully developed symbolic communication. It is only at that stage that modern behaviour emerged.

From the fossil record it is possible to suggest a tentative time scale for the evolutionary processes involved in Fig. 38. An indication that brain enlargement may have been initiated as early as 600 000 years ago is in the morphology of the fossil remains of archaic *Homo sapiens* in Africa (Rightmire 1998) such as Bodo, Ndutu and Saldanha. These fossil finds are associated with Acheulian artefacts which in Byers' (1994) terminology show style 1. The implication is that behaviour was not fully modern and that communication was through a proto-language. It is expected that the period necessary for genetic fixation given the long human generation interval, would have been of the order of 100 000 years or longer. As the EMB hypothesis suggests a minimum age of more than 115 000 years ago for fully developed symbolic communication, this would have emerged sometime prior to this and possibly considerably earlier. If one accepts that the Florisbad calvarium is close to the transition between archaic and modern *Homo sapiens* (Lahr 1996) and that this fossil is about 250 000 (Grün *et al.* 1996) years old then there is some indication of the antiquity of modern human behaviour. Accepting a window of time between 600 000 and 115 000 years ago and allowing for the uncertainties in the dating of Florisbad, it can be suggested that the emergence of modern behaviour was unlikely to have been more recent than 200 000 years ago or earlier than 400 000 years ago. The earliest Middle Stone Age occurrences (Barham & Smart 1996; McBrearty *et al.* 1996) date to the late Middle Pleistocene. It can be predicted that stylistic trends, noted at Klasies River main site, would be evidenced in those later Middle Pleistocene occurrences. The earlier record of the Middle Stone Age, and the transition between the Acheulian and the Middle Stone Age, need to be researched in terms of the emergence for symbolic behaviour. The conventionally accepted estimate of 40 000 years ago for the emergence of symbolic behaviour appears to be a gross underestimate.

CHAPTER 8

CONCLUDING DISCUSSION

In 1967 and 1968 Singer and Wymer undertook a large scale archaeological investigation of the main site depository and other occurrences near the mouth of the Klasies River. This led to their publication of the important 1982 monograph that gives a wealth of detailed information about the stratigraphy, the excavations and the finds. A long sequence like that exposed in main site allows the study of change through time. The contents of the layers of occupation can be compared to identify change through the sequence. This process is not carried out in a theoretical vacuum. It involves assumptions about how change is recognised and how changes should be interpreted. The monograph has created an impression that the Middle Stone Age was a very extended period showing little significant cultural change. The following quotation (Singer & Wymer 1982:64) illustrates their thinking:

> "..remains to be seen whether there are any features, throughout the long sequence represented by these stages which justify any conclusions that can be interpreted as changes in industrial tradition, changes which might indicate cultural development or allow the different stages to be recognised and thus affect local or more distant correlations. There *are* changes, but not very marked ones. They are probably sufficient to enable the MSA stages in the immediate locality to be placed within the sequence, but it is very questionable whether they would have any bearing on more distant MSA sites, especially the inland ones". (italics in the original)

The emphasis of the monograph was on providing information on the considerable numbers of finds made. It was the sheer enormity of the data to be processed that kept interpretation at a general level. The idea that there are no marked changes follows from this.

Why Singer and Wymer emphasised the lack of changes was because they expected significant change to be reflected in temporal variation in retouched formal tool types. It is only in the Howiesons Poort that there was an indication of typological change that their methodology recognised. It was an issue for them (Singer & Wymer 1982:114) that the Howiesons Poort "intruders" despite their significantly different industry seemingly occupied the same "ecological niche" as their predecessors and successors. For them changes in typology of the artefacts and other materials were a way to document any progressive advances in the lifeways of the inhabitants at the site. This was their objective in studying the Middle Stone Age.

This investigation is also a study of change, but follows a different approach and allows for a different reading of the record. Rather than using the conventional typological approach to the study of changes in the stone artefact sequence, it attempts to include technological information. In artefact production systems like that of the Middle Stone Age in which the investment is in the preparation of the core to produce preformed final products, changes are evident in the methods and techniques rather than retouched end-products. Whereas the student of typology may see change as limited or of little significance, the student of technology may come to very different conclusions. Singer & Wymer (1982) recognise changes in the main site sequence that from a technological perspective are more significant than they suggest.

They described these changes as a series of sub-stages, MSA 1, MSA 11, Howiesons Poort, MSA 111 and MSA 1V. Although the typological differences between the sub-stages may seem of little significance, they represent different artefact production systems. The culture-stratigraphic sequence that Singer & Wymer (1982) constructed is robust and fully supported by this study. Each sub-stage represents a different set of conventions in artefact production and the main changes in the sequence, if not all the subtle ones, have been identified. The question remains why are these changes meaningful?

The changes are not about different tribes invading the territories of others or dramatic advances in ways of getting food. They have to do with behaviour. The sub-stages reflect behaviour in that they represent arbitrary changes in ways of making artefacts. This arbitrary conventionality is significant because it is the most important marker of modern behaviour. In this dissertation, it has been argued that stylistic change is evidence for a warranting role of material culture in societies that communicate symbolically. In the main site sequence there are stylistic changes in ways of making artefacts that cannot be linked to function. They are not about progress and are not about better tools for better jobs.

The changes identified in the sequence represent different conventions in methods and techniques used in making different kinds of end products. The earliest sub-stage, the MSA 1, is characterised by long thin blades and points in quartzite. The platforms are thin relative to length and show preparation in rubbing and step flaking. The occurrence of flat dorsal scars on the products suggests specialised preparation of the active surface of the core. This allows the striking of very slender blanks in what is a hard and intractable material.

In the overlying MSA 1l, the characteristic artefacts are thick, wide platformed points that have a prominent bulb of percussion. These were produced by a classic 'Levallois' technology. Few regular blades were produced and the whole artefact production system was directed at making points. There is a clear stylistic trend in point length and points tend to become shorter and narrow towards the top of the SAS member. The points are preformed blanks and formal retouch is infrequent and restricted to sharpening the tip or shaping the butt. However, informal retouch in the form of edge modification is relatively common and found on about half of the points. In terms of typology the points are simple. This, however, belies the narrow technological constraints in their production. In terms of technology, this is the most distinctive sub-stage in the sequence. The MSA 1l points are products that are as patterned as backed artefacts in the overlying Howiesons Poort horizon.

The Howiesons Poort is synonomous with the occurrence of backed artefacts formed by the formal retouch of short, thin blade blanks. In the production of the blanks for retouch, core reduction appears to have been similar to that used in the MSA 1 sub-stage. In both sub-stages blade production is a feature. The Howiesons Poort blade blanks show very small, high angled, off-centred platforms and these are as characteristic as the backed artefacts. Raw material selection is a feature of the Howiesons Poort sub-stage and there is a marked increase in the use of non-local raw material relative to the underlying layers. As raw material usage shows a strong stylistic trend that is continuous through the sequence, it appears that part of the Middle Stone Age cultural succession is not represented at main site. As discussed in Appendix 3, a silcrete industry with bifacial points and similar platform attributes to the Howiesons Poort levels has been recovered from the site of Paardeberg in the Long Kloof, inland of main site. At Paardeberg the silcrete industry overlies an equivalent of the MSA 11, and this silcrete industry may be a distinct sub-stage that is not represented in the main site sequence. New excavations at Blombos Cave (Henshilwood & Sealy 1997) have produced an industry that may allow re-definition of the Stillbay sub-stage in the type area. Until details like the methods and techniques of artefact production are published for the Blombos Cave sample, comparisons cannot be made. However, the industry of Paardeberg would seem to conform to the traditional concept of a Still Bay sub-stage.

The post-Howiesons Poort deposits are not well represented at main site and the samples of artefacts available for study are limited. The artefacts from the Upper member placed in the MSA 111 show a different artefact production system from the other stages and what similarities there are, are with the Howiesons Poort rather than the MSA 11. The long serrated knives in the MSA 111 are impressive end products and typologically distinctive. No similar artefacts occur anywhere else within the main site sequence. The MSA 1V sample is too small to be informative but gives the impression of being a late sub-stage.

In Chapter 2, it was noted that the numbering of sub-stages in the Middle Stone Age adopted by Singer and Wymer was a departure from the normal practice. A further development has been a re-numbering of Middle Stone Age sub-stages by Volman (1984). The result is a somewhat unsatisfactory and confusing mix of numerical and type locality terms. These different labels carry unwarranted connotations of differences in precision of definition. In Table 10 there is a proposal that would obviate this problem. The use of terminology is a matter of agreement rather than enforcement and acceptance depends on how useful particular labels are in expressing concepts.

Table 10. Suggested nomenclature for Middle Stone Age sub-stages

Named sub-stages	Numbered sub-stages (after Singer & Wymer 1982)	Chronology
Post-Howiesons Poort	**MSA III & IV**	**65 000 – 22 000**
Howiesons Poort		**< 70 000**
Still Bay		**< 80 000**
Mossel Bay	**MSA II**	**< 100 000**
Klasies River	**MSA I**	**< 115 000**

Singer and Wymer did not anticipate that the cultural succession they recognised at main site would have relevance for other than the immediate area. It is well established that there are industries in the same time-range throughout southern Africa that can be identified with the Howiesons Poort sub-stage (Deacon, H.J. 1992). This is probably true for the other sub-stages recognised in the main site sequence. For example, point industries like the MSA 11 have been described from many locations in South Africa (Goodwin 1930; Mason 1962; Sampson 1974). Conventions of artefact production in the Late Pleistocene Middle Stone Age seem to have been widely held and followed. Variation is more probably on a sub-continental rather than regional or local scale. This suggests that Singer and Wymer underestimated the wider relevance of the sequence they described. The cultural succession at Klasies River main site is repeated in part in other long sequence sites in southern Africa (Mason 1957, 1962; Wendt 1972; Beaumont 1978; Beaumont *et al.* 1978; Kaplan 1990; Mitchell & Steinberg 1992; Wadley & Harper 1989; Wadley 1997; Harper 1997; Vogelsang 1996; Avery *et al.* 1998).

The Middle Stone Age is traditionally considered to be restricted to regions south of the Sahara. Middle Palaeolithic industries, sometimes referred to as Mousterian or Levallois-Mousterian, are found in the Sahara and North Africa. An early Late-Pleistocene, non-Middle Palaeolithic industry, known as the Pre-Aurignacian has been recorded in some sequences. This is stratigraphically below the Middle Palaeolithic at the Haua Fteah Cave (McBurney 1967). Overlying the Middle Palaeolithic, in this site and in sequences in the Maghreb, is the Aterian industry. The Aterian of North Africa is as typologically distinctive as the Howiesons Poort of southern Africa and may occupy a similar temporal position in the sequence (Hublin 1992). The kinds of changes in the Late Pleistocene archaeological record in North Africa (Van Peer 1998) have a familiar ring. Issues of terminology rather than fundamental differences in modes of artefact production distinguish the Middle Palaeolithic of North Africa from the Middle Stone Age of southern Africa (Allsworth-Jones 1993). For too long parochial interests have dominated archaeology. The Out-of-Africa hypothesis forces thinking on a continental and even global scale and the challenge is to relate the evidence from Klasies River to the universe of sites of early modern humans.

This is not to suggest that the same sub-stages of the Middle Stone Age – Middle Palaeolithic would be found throughout the continent. Regional variation (Clark 1988, 1992) is evident, notably in very different expressions like the Howiesons Poort and the Aterian. High level similarities would be consistent with the continent-wide, early Late Pleistocene presence of anatomically and behaviourally modern people. This can be seen as the result of a shared capacity for symbolic communication expressed through regional networks. What is implied is that by the Late Pleistocene, biological changes had progressed to the stage where modern speech and symbolic ways of thinking were possible.

The main thrust of this dissertation is the evolution of behaviour from an archaeological perspective. The central questions are what is modern behaviour, how and when did it evolve and how might this evolutionary stage be recognised? To answer such questions, an approach grounded in archaeological, psychological and biological theory has been developed here.

Modern behaviour can be defined as the practice of symbolic communication that involves a unique memory or mnemonic strategy and speech. Symbolic communication is so fundamental to being human that it structures all facets of life. The meaning of everything is enmeshed in a symbolic web. Our symbolic universe is one of virtual reality. In answering how these unique abilities came about, the appeal cannot be to chance. There has to have been some biological process that allowed the evolution of these abilities. These abilities are not shared with chimpanzees or other extant primate relatives and are specific to the modern human clade. Memory and speech abilities are seated in the brain. What is unique about modern humans is the size and organisation of the brain. Brain sizes approached the modern range some 600 000 years ago and allowed for substantial reorganisation of the neural networks. A Baldwinian evolutionary process involving some initial level of symbolic thought and speech drove this reorganisation. For symbolic thought and speech to have become part of the species specific behaviour, the changes in brain organisation had to become genetically fixed. This is an important point because the time involved reaching fixation depends on a behaviour being invariate for thousands of generations. In a species with a long generation interval (Hill 1993), this period is of the order of tens of thousands if not hundreds of thousands of years. The estimate given here for the emergence of fully developed symbolic communication is some 300 000 years ago. From this stage we can expect evidence from African sites reflecting societal organisation within a symbolic web.

The archaeological record is the only source of information on thought patterns of the past. Archaeology is a study of the remains of material culture and material culture in turn is as vocal as any spoken language. In some sense artefacts are fossil thoughts. The reading of the ancient stone artefacts shows that our abilities to live our lives in virtual reality is not new, but part of our African heritage that can be traced back to the evolution of modern people. It is this that makes the evidence from the Klasies River main site and other early Late Pleistocene sites in Africa so important.

BIBLIOGRAPHY

Aiello, L.C. 1992. Allometry and the analysis of size and shape in human evolution. Journal of Human Evolution 22:127-147.

Aiello, L.C. 1996. Hominine preadaptations for language and cognition. In: Mellars, P. & Gibson, K. (eds) Modelling the early human mind:890-99. Cambridge: McDonald Institute Monographs.

Aiello, L.C. & Dunbar, R.I.M. 1993. Necortex size, group size and the evolution of language. Current Anthropology 34:184-193.

Allsworth-Jones, P. 1993. The archaeology of archaic and early modern Homo sapiens: an African perspective. Cambridge Archaeological Journal 3(1):21-39.

Ambrose, S.H. & Lorenz, K.G. 1990. Social and ecological models for the Middle Stone Age in Southern Africa. In: Mellars, P. (ed.) The emergence of modern humans:3-33. Edinburgh: Edinburgh University Press.

Ambrose, S.H. 1998a. Late Pleistocene human population bottlenecks, volcanic winter, and differentiation of modern humans. Journal of Human Evolution 34:623-651.

Ambrose, S.H. 1998b. Chronology of the Later Stone Age and food production in East Africa. Journal of Archaeological Science 25:377-392.

Ames, K.M. 1996. Archaeology, style and the theory of coevolution. In: Maschner, H.D.G. (ed.) Darwinian archaeologies:109-131. New York: Plenum Press.

Anderson-Gerfaud, P. 1990. Aspects of behaviour in the Middle Palaeolithic: functional analysis of stone tools from southwest France. In: Mellars, P. (ed.) The emergence of modern humans: an archaeological perspective:389-418. Edinburgh: Edinburgh University Press.

Arensburg, B., Schepartz, L.A., Tillier, A.M., Vandermeersch, B. & Rak, Y. 1990. A reappraisal of the anatomical basis for speech in Middle Paleolithic hominids. American Journal of Physical Anthropology 83:137-146.

Atran, S. 1990. Cognitive foundations of natural history - towards an anthropology of science. Cambridge: Cambridge University Press.

Avery, D.M. 1987. Late Pleistocene coastal environments of the southern Cape Province of South Africa: micromammals from Klasies River Mouth. Journal of Archaeological Science 14:405-421.

Avery, G., Cruz-Uribe, K., Goldberg, P., Grine, F.E., Klein, R.G., Lenardi, M.J., Marean, C.W., Rink, W.J., Schwarcz, H.P., Thackeray, A. & Wilson, M.L. 1998. The 1992-1993 excavations at the Die Kelders Middle and Later Stone Age cave site, South Africa. Journal of Field Archaeology 24:263-291.

Bada, J.L. & Deems, L. 1975. Accuracy of dates beyond the 14-C dating limit using the aspartic acid racemization reaction. Nature 255:218-219.

Barham, L.S. & Smart, P.L. 1996. An early date for the Middle Stone Age of central Zambia. Journal of Human Evolution 3:287-290.

Bar-Yosef, O. & Dibble, H.L. 1995. Preface. In: Dibble, H.L. & Bar-Yosef, O. (eds) The definition and interpretation of Levallois Technology:ix-xiii. Monographs in world archaeology No. 23. Wisconsin: Prehistory Press.

Bateman, R., Goddard, I., O'Grady, R., Funk, V.A., Mooi, R., Kress, W.J. & Cannell, P. 1990. Speaking of forked tongues. Current Anthropology 31(1):1-24.

Beaumont, P.B. 1973. The ancient pigment mines of southern Africa. South African Journal of Science 59:140-146.

Beaumont, P.B. 1978. Border Cave. Cape Town: University of Cape Town, Masters Thesis.

Beaumont, P.B., De Villiers, H. & Vogel, J.C. 1978. Modern man in Sub-Saharan Africa prior to 49 000 years B.P.: a review and evaluation with particular reference to Border Cave. South African Journal of Science 74:409-419.

Berlin, B. 1992. Ethnobiological classification: principles of categorization of plants and animals in traditional societies. Princeton: Princeton University Press.

Bickerton, D. 1990. Language and species. Chicago: University of Chicago Press.

Binford, L.R. 1984. Faunal remains from Klasies River Mouth. New York: Academic Press.

Binford, L.R. 1989. Isolating the transition to cultural adaptations: an organizational approach. In: Trinkhaus, E. (ed.) The emergence of Modern Humans: biocultural adaptations in the later Pleistocene:18-41. Cambridge: Cambridge University Press.

Bishop W.W. & Clark J.D. 1967. Background to evolution in Africa. Chicago: University of Chicago Press.

Boëda, E. 1995. Levallois: a volumetric construction, methods, a technique. In: Bar-Yosef, O. & Dibble, H.L. (eds) The definition and interpretation of Levallois Technology:41-68. Monographs in world archaeology No. 23. Wisconsin: Prehistory Press.

Boone, J.L. & Smith, E.A. 1998. Is it evolution yet? A critique of evolutionary archaeology. Current Anthropology 39, supplement:141-173.

Bordes, F. 1961. Typologie du Paleolithique ancien et moyen. Bordeaux: Delmas.

Bordes, F. & Crabtree, D. 1969. The Corbiac blade technique and other experiments. Tebiwa 12:1-21.

Boyd, B., Petitt, P. & White, M. 1995. Comment on Knight, C., Power, C. & Watts, I. The human symbolic revolution: a Darwinian account. Cambridge Archaeological Journal 5(1):75-114.

Brain, C.K. & Shipman, P. 1993. The Swartkrans bone tools. In: Brain, C.K. (ed.) Swartkrans, a cave's chronicle of early man:195-216. Transvaal Museum Monograph No 8.

Bräuer, G., Deacon, H.J. & Zipfel, F. 1992. Comment on the new maxillary finds from Klasies River, South Africa. Journal of Human Evolution 23:419-422.

Bräuer, G., Yokoyama, Y., Falquères, C. & Mbua, E. 1997. Modern human origins backdated. Nature 386:337.

Brooks, A.S., Helgren, D.M., Cramer, J.S., Franklin, A. Hornyak, W., Keating, J.M., Klein, R.G., Rink, W.J., Schwarcz, H.P., Smith, J.N.L., Stewart, K., Todd, N.E., Verniers, J & Yellen, J.E. 1995. Dating and context of three Middle Stone Age sites with bone points in the Upper Semliki Valley, Zaire. Science 268:548-53.

Butzer, K.W. 1978. Sediment stratigraphy of the Middle Stone Age sequence at Klasies River Mouth, Tsitsikama Coast, South Africa. South African Archaeological Bulletin 33:141-151.

Butzer, K.W. 1982. Geomorphology and sediment stratigraphy. In: Singer, R. and Wymer, J.J. (eds) The Middle Stone Age at Klasies River Mouth, South Africa:33-42. Chicago: University of Chicago Press.

Byers, A.M. 1994. Symboling and the Middle-Upper Palaeolithic transition: a theoretical and methodological critique. Current Anthropology 35:369-400.

Byers, A.M. 1999. Communication and material culture: Pleistocene tools as action cues. Cambridge Archaeological Journal 9(1):23-41.

Callahan, E. 1987. An evaluation of the lithic technology in Middle Sweden during the Mesolithic and Neolithic. *Aun* 8. UppaL.

Calvin, W. 1983. The throwing Madonna. New York: McGraw-Hill.

Calvin, W. 1991. The ascent of mind. New York: Bantam Books.

Cann, R.L., Stoneking, M. & Wilson, A.C. 1987. Mitochondrial DNA and human evolution. Nature 325:31-35.

Caspari, R. & Wolpoff, M.H. 1990. The morphological affinities of the Klasies River Mouth skeletal remains. American Journal of Physical Anthropology 81:203.

Chase, P.G. 1991. Symbols and Palaeolithic artefacts: Style, standardization, and the imposition of arbitrary form. Journal of Anthropological Archaeology 10:193-214.

Chase, P.G. 1993. Archaeology and the cognitive sciences in the study of human evolution. Comment on Donald, M. Précis of Origins of the modern mind. Behavioral and Brain Science 16:737-791.

Chase, P.G. & Dibble, H.L. 1987. Middle Palaeolithic symbolism: a review of current evidence and interpretations. Journal of Anthropological Archaeology 6:263-96.

Chazan, M. 1995. The language hypothesis and lithic analysis. Current Anthropology 36(5):749-768.

Chazan, M. 1997. Lead Review - redefining Levallois. Journal of Human Evolution 33:719-735.

Clark, A.M.B. 1997. The final Middle Stone Age at Rose Cottage Cave: a distinct industry in the Basutolian ecozone. South African Journal of Science 93:449-458.

Clark, A.M.B. 1999. Late Pleistocene technology at Rose Cottage Cave: a search for modern behavior in an MSA context. African Archaeological Review 16(2):93-119.

Clark, J.D. 1959. The prehistory of southern Africa. Harmondsworth: Penguin.

Clark, J.D. 1977. Interpretations of prehistoric technology from ancient Egyptian and other sources. Paleorient (3):127-50.

Clark, J.D. 1988. The Middle Stone Age of East Africa and the beginnings of regional identity. Journal of World Prehistory 2(3):235-305.

Clark, J.D. 1992. African and Asian perspectives on the origins of modern humans. Philosophical Transactions of the Royal Society, London B 337:201-15.

Clark, J.D., Phillips, J.L. & Staley, P.S. 1974. Ancient Egyptian bows and arrows and their relevance for African Prehistory. Paleorient 2(2):323-88.

Close, A.E. & Sampson, C.G. 1998. Recent backed microlith production in central South Africa. Lithic Technology 23(1):5-19.

Conkey, M.W. 1978. Style and information in cultural evolution: towards a predictive model for the Paleolithic. In: Redman, C.L., Bergman, M.J., Curtin, E.V., Langhorne Jr. W.J., Versaggi, N. and Wanser, J.C. (eds) Social Archaeology: 61-85. New York: Academic Press.

Conkey, M.W., Soffer, O., Stratmann, D. & Jablonski, N.G. 1997. Beyond art: Pleistocene image and symbol. Wattis symposium series in anthropology. Memoirs of the California academy of sciences no 23. San Franscisco: California Academy of Sciences.

Cotterell, B. & Kamminga, J. 1987. The formation of flakes. American Antiquity 52(4):675-708.

Cotterell, B. & Kamminga, J. 1990. Mechanics of pre-industrial technology. New York: Cambridge University Press.

Daniel, G.E. 1950. A hundred years of archaeology. London: Gerald Duckworth & Co.

Davidson, I. 1997. The power of pictures. In: Conkey, M.W., Soffer, O., Stratmann, D. & Jablonski, N.G. (eds) Beyond art: Pleistocene image and symbol:125-160. Wattis symposium series in anthropology. Memoirs of the California academy of sciences no 23. San Franscisco: California Academy of Sciences.

Davidson, I. & Noble, W. 1989. The archaeology of perception: traces of depiction and language. Current Anthropology 30: 125-55.

Davidson, I. & Noble, W. 1993. Tools and language in human evolution In: Gibson, K.R. and Ingold, T. (eds) Tools, Language and Cognition in Human Evolution:363-388. Cambridge: Cambridge University Press.

Davidson, I. & Noble, I. 1998. Two views on language origins. Viewpoint: the origins of speech. Cambridge Archaeological Journal 8(1):82-88.

Davis, Z.J. & Shea J.J. 1998. Quantifying lithic curation: an experimental test of Dibble and Pelcin's original flake-tool mass predictor. Journal of Archaeological Science 25:603-610.

Dawkins, R. 1976. The selfish gene. New York: Oxford University Press.

Deacon, H.J. 1966. Note on the x-ray of two mounted implements from South Africa. Man 1(1):87-90.

Deacon, H.J. 1967. The Langkloof Archaeological Research Project. Palaeoecology of Africa 9:149-150.

Deacon, H.J. 1976. Where Hunters gathered. A study of Holocene Stone Age people in the Eastern Cape. South African Archaeological Society Monograph Series 1, South African Archaeological Society, Claremont, Cape Town.

Deacon, H.J. 1985. Review of Binford, L.R. 1984. Faunal remains from Klasies River Mouth. New York: Academic Press. South African Archaeological Bulletin 40:59-60.

Deacon, H.J. 1988. The origins of anatomically modern people and the South African evidence. In: Heine, K. (ed.) Palaeoecology of Africa and the surrounding islands Vol 19:193-199. Southern African society for Quaternary Research. Proceedings of the Vlllth biennial conference held at the University of Free State, 20-24 March 1987.

Deacon, H.J. 1989. Late Pleistocene palaeoecology and archaeology in the southern Cape, South Africa. In: Mellars, P. and Stringer, C. (eds) The Human revolution: behavioural and biological perspectives on the origins of modern humans:547-564. Edinburgh: Edinburgh University Press.

Deacon, H.J. 1992. Southern Africa and modern human origins. Philosophical Transactions of the Royal Society, London B 337:177-183.

Deacon, H.J. 1995. Two Late Pleistocene-Holocene archaeological depositories from the southern Cape, South Africa. South African Archaeological Bulletin 50:121-131.

Deacon, H.J. 1998. Elandsfontein and Klasies River revisited. In: Ashton, N.M., Healy, F. & Pettitt, P.B. (eds) A master of his craft: papers in Stone Age archaeology presented to John Wymer:23-28. Oxford: Oxbow Books.

Deacon, H.J. *in press* Modern human emergence: an African archaeological perspective. In: Proceedings of the Dual Congress held in 1998, Johannesburg.

Deacon, H.J. & Deacon, J. 1999. Human beginnings in South Africa – uncovering the secrets of the Stone Age. Cape Town: David Philip Publishers.

Deacon, H.J. & Geleijnse, V.B. 1988. The stratigraphy and sedimentology of the main site sequence, Klasies River, South Africa. South African Archaeological Bulletin 43:5-14.

Deacon, H.J. & Schuurman, R. 1992. The origins of modern people: the evidence from Klasies River. In: Bräuer, G. & Smith, F.H. (eds) Continuity or replacement: controversies in Homo sapiens evolution:121-129. Rotterdam: Balkema.

Deacon, H.J., Talma, A.S. & Vogel, J.C. 1988. Biological and cultural development of Pleistocene people in an Old World southern continent. In: Prescott, J.R. (ed.) Early man in the southern hemisphere: S23-S31. Adelaide: Department of Physics and Mathematical Physics, University of Adelaide.

Deacon, H.J. & Wurz, S. 1996. Klasies River main site, cave 2: a Howiesons Poort occurrence. In: Pwiti, G. & Soper, R. (eds) Aspects of African Archaeology:213-218. Harare: University of Zimbabwe Publications.

Deacon, J. 1972. Wilton: an assessment after fifty years. South African Archaeological Bulletin 27:10-45.

Deacon, J. 1979. The Howiesons Poort and related industries in southern Africa with special reference to the name site collection. Paper presented at a workshop of the Southern African Association of Archaeologists, Stellenbosch.

Deacon, J. 1984. The Later Stone Age of Southernmost Africa. British Archaeological Reports, International Series 213, Oxford.

Deacon, J. 1990. Weaving the stone age fabric of southern Africa. In: Robertshaw, P. (ed.) A history of African archaeology: 39-58. London: James Currey.

Deacon, J. 1992. Arrows as agents of belief amongst the /Xam Bushmen. Margaret Shaw lecture 3. S.A. Museum: Cape Town.

Deacon, J. 1995. An unsolved mystery at the Howieson's Poort name site. South African Archaeological Bulletin 162:110-120.

Deacon, T.W. 1988. Human brain evolution. II. Embryology and brain allometry. In: Jerison, H & Jerison, I (eds) Intelligence and evolutionary biology:383-415. Berlin: Springer-Verlag.

Deacon, T.W. 1997a. The symbolic species - the co-evolution of language and the human brain. Harmondsworth: Penguin Books.

Deacon, T.W. 1997b. What makes the human brain different? Annual Review of Anthropology 26:337-357.

Deregowski, J.B. 1993. What about pictures? Comment on Donald, M. Précis of origins of the modern mind. Behavioral and Brain Science 16:757-758.

Dibble, H.L. 1987. The interpretation of Middle Paleolithic scraper morphology. American Antiquity 52:109-17.

Dibble H.L. 1989. The implication of stone tool types for the presence of language during the Lower and Middle Palaeolithic. In: Mellars, P. and Stringer, C. (eds) The Human revolution: 415-43. Edinburgh: Edinburgh University Press.

Dibble, H.L. 1991. Mousterian assemblage variety on an interregional scale. Journal of Anthropological Research 47:239-57.

Dibble, H.L. 1997. Platform variability and flake morphology: a comparison of experimental and archaeological data and implications for interpreting prehistoric lithic technological strategies. Lithic Technology 22:150-170.

Dibble H.L. 1998. Comment on Davis, Z.J. & Shea J.J. 1998. Quantifying lithic curation: an experimental test of Dibble and Pelcin's original flake-tool mass predictor. Journal of Archaeological Science 25:611-613.

Dibble, H.L. & Rolland, N. 1992. On assemblage variability in the Middle Palaeolithic of Western Europe: history, perspectives, and a new synthesis. In: Dibble, H.L. & Mellars, P.A. (eds) The Middle Paleolithic: adaptation, behavior and variability:1-28. Philadelphia: University of Pennsylvania University Museum Monographs No. 72.

Dibble, H.L. & Pelcin, A. 1995. The effect of hammer mass and velocity on flake mass. Journal of Archaeological Science 22:429-439.

Dibble, H.L. & Whittaker, J.C. 1981. New experimental evidence on the relation between percussion flaking and flake variation. Journal of Archaeological Science 8:283-296.

Donald, M. 1991. Origins of the modern mind. Cambridge MA: Harvard University Press.

Donald, M. 1993. Précis of Origins of the modern mind. Behavioral and Brain Science 16:737-791.

Duff, A.I., Clark, G.A. and Chadderton, T.J. 1992. Symbolism in the early Palaeolithic: a conceptual odyssey. Cambridge Archaeological Journal 2:211-229.

Dunbar, R. 1993. Co-evolution of neocortex size, group size and language in humans. Behavioural and Brain Sciences 16:681-735.

Dunnell, R.C. 1978. Style and function: a fundamental dichotomy. American Antiquity 35:304-319.

Dunnell, R.C. 1996. Foreword. In: O'Brien, M.J. (ed.) Evolutionary archaeology: theory and application:vii-xii. Salt Lake City: University of Utah Press.

Edelman, G. 1987. Neural Darwinism: The theory of neuronal group selection. New York: Basic Books.

Edelman, G. 1992. Bright air, brilliant fire – on the matter of mind. London: Penguin Books.

Falk, D. 1987. Hominid paleoneurology. Annual review of Anthropology 16:13-30.

Foley, R. 1995. Humans before humanity. Oxford: Blackwell.

Foley, R. & Lahr, M. 1997. Mode 3 technologies and the evolution of modern humans. Cambridge Archaeological Journal 7:3-36.

Frayer, D.W., Wolpoff, M.H., Thorne, A.G., Smith, F.H. & Pope, G.G. 1993. Theories of modern human origins: The paleontological test. American Anthropologist 95:14-50.

Gannon, P.J., Holloway, R.L., Broadfield, D.C. & Braun, A.R. 1998. Assymetry of chimpanzee planum temporale: humanlike brain pattern of Wernicke's language area homolog. Science 279:222-226.

Gannon, P.J. & Laitman, J.T. 1993. Can we see language areas on hominid brain endocasts? American Yearbook of Physical Anthropology (supplement) 16:91.

Goodwin, A.J.H. 1930. Chronology of the Mossel Bay industry. South African Journal of Science 26:562-572.

Goodwin, A.J.H. 1933. Some developments in technique during the Earlier Stone Age. Transactions of the Royal Society of South Africa 21:109-124.

Goodwin, A.J.H. 1958. Formative years of our prehistoric terminology. South African Archaeological Bulletin 13:25-33.

Goodwin, A.J.H. & Van Riet Lowe, C. 1929. The Stone Age cultures of South Africa. Annals of the South African Museum 27.

Gibson, K.R. 1996. The biocultural human brain, seasonal migrations, and the emergence of the Upper Palaeolithic. In: Mellars, P. & Gibson, K. (eds) Modelling the early human mind:33-48. Cambridge: McDonald Institute Monographs.

Gould, S.J. 1980. Living Archaeology. Cambridge: Cambridge University Press.

Greenberg, G., Partridge, T. & Weiss, E. & Haraway, M.M. 1999. Integrative levels, the brain, and the emergence of complex behavior. Review of General Psychology 3(3):168-187.

Greenfield, S. 1997. The human brain: a guided tour. London: Weidenfeld & Nicolson.

Groves, C.P. 1989. A theory of human and primate evolution. Oxford: Clarendon Press.

Grün, R, Shackleton, N.J. & Deacon, H.J. 1990. Electron-spin resonance dating of tooth enamel from Klasies River Mouth Cave. Current Anthropology 31:427-432.

Grün, R., Brink, J.S., Spooner, N.A., Talyor, L., Stringer, C.B., Franciscus, R.G. & Murray, A.S. 1996. Direct dating of Florisbad hominid. Nature 382:500-501.

Harpending, H. & Relethford, J. 1997. Population perspectives on human origins research. In: Clark, G.A. & Willermet, C.M. (eds) Conceptual issues in modern human origins research:361-368. New York: Aldine de Gruyter.

Harper, P.T. 1994. The Middle Stone Age sequence at Rose Cottage Cave: a search for continuity and discontinuity. Johannesburg: University of the Witwatersrand, Masters Thesis.

Harper, P.T.N. 1997. The Middle Stone Age sequence at Rose Cottage Cave: a search for continuity and discontinuity. South African Journal of Science 93:470-475.

Hayden, B. & Hutchings, W. 1989. Whither the billet flake? In Amick, D. & Mauldin, R. (eds) Experiments in lithic technology. British Archaeological Reports. British Series 528:235-258.

Heese, C.H.T.D. 1933. The evolution of Palaeolithic technique. Annals of the University of Stellenbosch ll(2):1-65.

Henderson, Z.L. 1990. Aspects of the archaeology of Klasies River: a study of context and association in shelter 1B. Stellenbosch: University of Stellenbosch, Masters Thesis.

Henshilwood, C. & Sealy, J. 1997. Bone artefacts from the Middle Stone Age at Blombos Cave, southern Cape, South Africa. Current Anthropology 38(5):890-895.

Henshilwood, C. & Sealy, J. 1998. Blombos cave. In: Deacon, H.J. (ed.) Excursion guide to sites north and east of Cape Town. Dual Congress:42-46.

Hewitt, J. 1955. Further light on the Bowker implements. South African Archaeological Bulletin 10:94-95.

Hill, K. 1993. Life history and evolutionary anthropology. Evolutionary Anthropology 2:78-88.

Hodder, I. 1982. Symbols in action: ethnoarchaeological studies of material culture. Cambridge: Cambridge University Press.

Holloway, R.L. 1983. Human paleontological evidence relevant to language behavior. Human Neurobiology 2:105-114.

Holloway, R.L. 1995. Comment on Aiello, L. and Wheeler, P. The expensive tissue hypothesis. Current Anthropology 36:213-214.

Hublin, 1992. Recent human evolution in northwestern Africa. Philosophical Transactions of the Royal Society, London B 337:185-191.

Kaplan, J. 1990. The Umhlatuzana rock shelter sequence: 100 000 years of Stone Age history. Natal Museum Journal of Humanities 2:1-94.

Keller, C.M. 1973. Montagu Cave in prehistory: a descriptive analysis. University of California Anthropological Records 28:1-98.

Kim, J. 1998. The mind-body problem after fifty years. In O'Hear, A. (ed.) Current issues in philosophy of mind. Supplement to "Philosophy", Royal institute of Philosophy:43:3-22.

Kien, J. 1991. The need for data reduction may have paved the way for the evolution of language ability in hominds. Journal of Human Evolution 20:157-165.

Klein, R.G. 1976. The mammalian fauna of the Klasies River Mouth site, southern Cape Province, South Africa. South African Archaeological Bulletin 31:75-99.

Klein, R.G. 1989. Biological and behavioural perspectives on modern human origins in Southern Africa. In: Mellars, P. and Stringer, C. (eds) The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans:529-546. Edinburgh: Edinburgh University Press.

Klein, R.G. 1992. The archaeology of modern human origins. Evolutionary Anthropology 1(1):5-14.

Klein R.G. 1995. Anatomy, behaviour and modern human origins. Journal of World Prehistory 9:167-98.

Klein, R.G. 1999. Review of Deacon, H.J. & Deacon, H.J. 1999. Human beginnings in South Africa: Uncovering the secrets of the Stone Age. Cape Town: David Philip. South African Archaeological Bulletin 54:147-153.

Knight, C. Power, C. & Watts, I. 1995. The human symbolic revolution: a Darwinian account. Cambridge Archaeological Journal 5(1):75-114.

Knutsson, K. 1988. Making and using stone tools - the analysis of the lithic assemblages from Middle Neolithic sites with flint in Västerbotten, Sweden. Uppsala: University of Uppsala, PhD thesis.

Kosslyn, M. S. & Andersen, R.A. 1992. Frontiers in cogntitive neuroscience. London: MIT Press.

Landau, M. 1991. Narratives of human evolution. New Haven, CT: Yale University Press.

Lahr, M.M. 1996. The evolution of modern human diversity. Cambridge: Cambridge University Press.

Laitman, J.T. 1985. Later Middle Pleistocene hominids. In: Delson, E. (ed.) Ancestors: the hard evidence:265-267. New York: Alan R. Liss.

Laitman, J.T., Reidenberg, J.S., Friedland, D.R., Reidenberg, B.E. & Gannon, P.J. 1993. Neandertal upper respiratory specializations and their effect upon respiration and speech. American Journal of Physical Anthropology (Supplement) 16:129.

Leach, E. 1973. Concluding address. In: Renfrew, C. (ed.) The explanation of culture change: 761-771.

Leslie-Brooker, M. 1987. An archaeological study of the Uniondale rockshelter Albany District Eastern Cape. Stellenbosch: University of Stellenbosch, Masters Thesis.

Lewontin, R.C. 1997. Genes, environment, and organisms. In: Silvers, R.B. (ed.) Hidden histories of science:115-140. London: Granta Books.

Lieberman, P. 1984. The biology and evolution of language. Cambridge,MA: Harvard University Press.

Lieberman, P. 1989. The origins of some aspects of human language and cognition. In: Mellars, P. and Stringer, C. (eds) The Human revolution: behavioural and biological perspectives on the origins of modern humans:415-43. Edinburgh: Edinburgh University Press.

Lieberman, P. & Crelin, E.S. 1971. On the speech of Neanderthal man. Linguistic Inquiry 2:203-222.

Lieberman, P., Laitman, J.T., Reidenberg, J.S. & Gannon, P.J. 1992. The anatomy, physiology, acoustics and perception of speech: essential elements in analysis of the evolution of human speech. Journal of Human Evolution 23:447-467.

Lieberman, D. E. & McCarthy, R.C. 1999. The ontogeny of cranial base angulation in humans and chimpanzees and its implications for reconstructing pharyngeal dimensions. Journal of Human Evolution 6:487-517.

MacLarnon, A.M. & Hewitt, G.P. 1993. The vertebral canal. In: Walker, A. & Leakey, R.E.F. (eds) The Nariokotome Homo erectus skeleton:359-390. Cambridge Massachusetts: Harvard University Press.

MacLarnon, A.M. 1999. The evolution of human speech: the role of enhanced breathing control. American Journal of Physical Anthropology 109:341-363.

Marean, C. 1998. A critique of the evidence for scavenging by Neandertals and early modern humans: new data from Kobeh Cave (Zagros Mountains, Iran) and Die Kelders Cave 1 Layer 10 (South Africa). Journal of Human Evolution 35:111-136.

Martinson, D.G., Pisias, N.G., Hays, J.D., Imbrie, J., Moore, T.C. & Shackleton, N.J. 1987. Age dating and orbital theory of the ice ages: development of a high-resolution 0-to-300 000-year chronostratigraphy. Quaternary Research 27:1-29.

Mason, R.J. 1957. The Transvaal Middle Stone Age and statistical analysis. South African Archaeological Bulletin 12:119-137.

Mason, R.J. 1962. Prehistory of the Transvaal. Johannesburg: University of the Witwatersrand Press.

McBrearty, S., Bishop, L. & Kingston, J. 1996. Variability in traces of Middle Pleistocene hominid behavior in the Kapthurin Formation, Baringo, Kenya. Journal of Human Evolution 30:563-580.

McBurney, C.B.M. 1967. The Haua Fteah (Cyrenaica) and the Stone Age of the south-east Mediterranean. Cambridge: Cambridge University Press.

McHenry, H.M. 1992. How big were early hominids? Evolutionary Anthropology 1:15-19.

Mehlman, M.J. 1989. Later Quaternary archaeological sequences in northern Tanzania. University of Illinois at Urbana-Champaign, PhD thesis.

Mellars, P.A. 1991. Cognitive changes and the emergence of modern humans. Cambridge Archaeological Journal 1(1):63-76.

Mellars, P. 1996a. Symbolism, language and the Neanderthal mind. In: Mellars, P. & Gibson, K. (eds) Modelling the early human mind:15-32. Cambridge: McDonald Institute Monographs.

Mellars, P. 1996b. The Neanderthal legacy – an archaeological perspective from Western Europe. Princeton: Princeton University Press.

Mellars, P. 1998. Modern humans, language, and the "symbolic explosion". Viewpoint: the origins of speech. Cambridge Archaeological Journal 8(1):88-90.

Miller, G.H., Beaumont, P.B., Deacon, H.J., Brooks, A.S., Hare, P.E. & Jull, A.J.T. 1999. Earliest modern humans in southern Africa dated by isoleucine epimerization in ostrich eggshell. Quaternary Geochronology (Quaternary Science Reviews)18:1573-1548.

Miller, G.H., Beaumont, P.B., Jull, A.J.T. & Johnson, B. 1992. Pleistocene geochronology and palaeothermometry from protein diagenesis in ostrich eggshells: implications for the evolution of modern humans. Philosophical Transactions of the Royal Society, London B 337:149-158.

Milo, R.G. 1994. Human-animal interactions in southern African prehistory: a microscopic study of bone damage signatures. Chicago: University of Chicago, PhD thesis.

Milo, R.G. 1998. Evidence for hominid predation at Klasies River Mouth, South Africa, and its Implications for the behaviour of early modern humans. Journal of Archaeological Science 25:99-133.

Milo, R.G. & Quiatt, D. Glottogenesis and anatomically modern Homo sapiens: the evidence for and implications of a late origin of vocal language. Current Anthropology 34(5):523-568.

Mitchell, P.J. & Steinberg, J.M. 1992. Ntloana Tsoana: a Middle Stone Age sequence from western Lesotho. South African Archaeological Bulletin 47:26-33.

Mithen, S. 1996. The prehistory of the mind: a search for the origins of art, religion and science. London: Thames and Hudson.

Movius, H.L., David, N.C., Bricker, H.M. & Clay, R.B. 1968. The analysis of certain major classes of Upper Palaeolithic tools. Cambridge (Mass.): Peabody Museum, Harvard University. (American School of Prehistoric Research Bulletin 26).

Müller, R.A. 1996. Innateness, autonomy, universality? Neurobiological approaches to language. Behavioral and Brain Sciences 19:611-675.

Neiman, F.D. 1995. Stylistic variation in evolutionary perspective: inferences from decorative diversity and interassemblage distance in Illinois woodland ceramic assemblages. American Antiquity 60(1):7-36.

Newcomer, M.H. 1975. "Punch technique" and Upper Palaeolithic blades. In: Swanson, E. (ed.) Lithic Technology, making and using stone tools:105-114. The Hague: Mouton Publishers.

Noble, W. & Davidson, I. 1991. The evolutionary emergence of modern human behaviour: language and its archaeology. Man 26:223-54.

Noble , W. & Davidson, I. 1993. Tracing the emergence of modern behavior. Journal of Anthropological Archaeology 12:121-149.

Noble, W. & Davidson, I. 1996. Human evolution, language and mind - a psychological and archaeological inquiry. Cambridge: Cambridge University Press.

Nuzhnyi, D.J. 1989. L'utilisation des microlithes géométriques et non géométriques comme armatures des projectiles. Bulletin de la Société Préhistorique, Francaise, 86(3):88-96.

Nuzhnyi, D.J. 1990. Projectile damage on Upper Paleolithic microliths. Use of Bow and Arrow among Pleistocene hunters in the Ukraine. In: Proceedings of the International Conference on lithic use-wear analysis, 15th - 17 th February 1989 in Uppsala, Sweden:113-124. Societas Archaeologica Upsaliensis, Uppsala 1990.

O'Brien M.J. & Holland, T.D. 1992. The role of adaptation in archaeological explanation. American Antiquity 57(1):36-59.

Parkington, J.E. 1990. A critique of the consensus view on the age of Howieson's Poort assemblages in South Africa. In: Mellars, P. (ed.) The emergence of modern humans: an archaeological perspective:34-55. Edinburgh: Edinburgh University Press.

Pelcin, A.W. 1998. The threshold effect of platform width: a reply to Davis and Shea. Journal of Archaeological Science 25:615-620.

Pelegrin, J. 1991. Sur une recherech technique experimentale des techniques de debitage laminaire. Actes du Collogue Internations 'Expèrimentation en archèologie: bilan et perspectives' les Avril 1988:118-167.

Plog, S. 1995. Approaches to style: complements and contrasts. In: Carr, C. & Neitzel, J.E. (eds) Style, society and person, archaeological and ethnological perspectives:269-383. London: Plenum Press.

Preucel, R.W. 1999. Review of: O'Brien, M.J. 1996. Evolutionary archaeology: theory and application. Salt Lake City: University of Utah Press. Journal of Field Archaeology 26:93-99.

Rightmire, G.P. 1998. Human evolution in the Middle Pleistocene: the role of *Homo heidelbergensis.* Evolutionary Anthropology 6:218-227.

Rightmire, G.P. & Deacon, H.J. 1991. Comparative studies of Late Pleistocene human remains from Klasies River Mouth, South Africa. Journal of Human Evolution 20:131-156.

Rilling, J.K. & Insel, T.R. 1999. The primate neocortex in comparative perspective using magnetic resonance imaging. Journal of Human Evolution 37:191-223.

Rolland, N. 1995. Levallois technique emergence: single or multiple? A review of the Euro-African record. In Dibble, H.L. & Bar-Yosef, O. (eds) The definition and interpretation of Levallois technology:333-360. Monographs in world archaeology no. 23. Wisconsin: Prehistory Press.

Rosch, E. H. 1973. Natural categories. Cognitive Psychology 4:328-50.

Rosch, E.H. 1978. Principles of categorisation. In: Rosch, E. and Lloyd, B. (eds) Cognition and Categorization:27-48. New Jersey: Lawrence Erlbaum Associates.

Rosch, E.H. & Mervis, C.B. 1996. Family resemblances: studies in the internal structure of categories. In: Geirsson, H. & Losonsky, M. (eds) Readings in language and mind:442-459. Oxford: Blackwell Publishers.

Ruff, C.B., Trinkhaus, E. & Holliday, T.W. 1997. Body mass and encephalization in Pleistocene *Homo*. Nature 387:173-176.

Sackett, J.R. 1977. The meaning of style in archaeology: a general model. American Antiquity 42:369-80.

Sackett, J.R. 1982. Approaches to style in lithic archaeology. Journal of Anthropological Archaeology 1:59-112.

Sackett, J.R. 1986. Isochrestism and style: a clarification. Journal of Anthropological Archaeology 5:266-77.

Sackett, J.R. 1990. Style and ethnicity in archaeology: the case for isochrestism. In: Conkey, M. & Hastorf, C. (eds) The uses of style in archaeology:32-43. Cambridge: Cambridge University Press.

Sacks, O. 1997. Scotoma: forgetting and neglect in science. In: Silvers, R.B. (ed.) Hidden histories of science:141-188. London: Granta Books.

Sampson, C.G. 1974. The Stone Age archaeology of southern Africa. New York: Academic Press.

Savage-Rumbaugh, E.S. 1986. Ape Language: From conditioned response to symbol. New York: Columbia University Press.

Savage-Rumbaugh, E.S. & Lewin, R. 1994. Kanzi: the ape at the brink of the human mind. New York: John Wiley.

Shackleton, N.J. 1982. Stratigraphy and chronology of the Klasies River Mouth deposits: oxygen isotope evidence. In: Singer, R and Wymer, J.J. (eds) The Middle Stone Age at Klasies River Mouth in South Africa:194-199. Chicago: University of Chicago Press.

Schepartz, L.A. 1993. Language and modern human origins. Yearbook of Physical Anthropology 36:91-126.

Schlanger, N. 1994. Mindful technology: unleashing the *chaîne opératoire* for an archaeology of mind. In: Renfrew, C. & Zubrow, E.B.W. (eds) The ancient mind: elements of cognitive archaeology: 143-51. Cambridge: Cambridge University Press.

Schoeneman, P.T. & Wang, S.Y. 1996. Evolutionary principles and the emergence of syntax. Comment on Müller, R. Innateness, autonomy, universality? Neurobiological approaches to language. Behavioral and Brain Sciences 19: 646-647.

Semendeferi, K., Damasio, H. & Randall, R. 1997. The evolution of the frontal lobes: a volumetric analysis based on three-dimensional reconstructions of magnetic resonance scans of human and ape brains. Journal of Human Evolution 32:375-388.

Sherratt, A. 1999. Creations of mind. Review of Mithen, S. (ed.) 1998. Creativity in human evolution and prehistory. London: Routledge. Cambridge Archaeological Journal 9(1):154-160.

Shott, M.J. 1996. An exegesis of the curation concept. Journal of Anthropological Research 52:259-280.

Singer, R. 1961. Pathology in the temporal bone of the Boskop skull. South African Archaeological Bulletin 63(16):103-105.

Singer, R. & Wymer, J. 1982. The Middle Stone Age at Klasies River Mouth in South Africa. Chicago: Chicago University Press.

Sinha, C. 1996. Theories of symbolization and development. In: Lock, A. & Peters, C.R. (eds) Handbook of human symbolic evolution: Oxford: Clarendon Press.

Soffer, O. & Conkey, M.W. 1997. Studying ancient visual cultures In: Conkey, M.W., Soffer, O., Stratmann, D. & Jablonski, N.G. (eds) Beyond art: Pleistocene image and symbol:1-16. Wattis symposium series in anthropology. Memoirs of the California academy of sciences no 23. San Franscisco: California Academy of Sciences.

Speth, J.D. 1972. Mechanical basis of percussion flaking. American Antiquity 37:34-60.

Stoneking, M. 1993. DNA and recent human evolution. Evolutionary Anthropology 2:60-73.

Stringer, C.B. & Andrews, P. 1988. Genetic and fossil evidence for the origin of modern humans. Science 239:1263-1268.

Stringer, C. & Gamble, C. 1993. In search of the Neanderthals: solving the puzzle of human origins. London: Thames and Hudson.

Stringer, C. & McKie, R. 1996. African exodus. London: Jonathan Cape.

Szathmáry, E. 1999. When the means do not justify the end. Review of Schwartz, J. H. 1999. Sudden origins: fossils, genes and the emergence of species. New York: Wiley. Science:745.

Thackeray, A.I. & Kelly, A.J. 1988. A technological and typological analysis of Middle Stone Age assemblages antecedent to the Howiesons Poort at Klasies River main site. South African Archaeological Bulletin 43:15-26.

Thackeray, A.I. 1989. Changing fashions in the Middle Stone Age: The stone artefact sequence from Klasies River main site, South Africa. African Archaeological Review 7:33-57.

Thackeray, A.I. 1992. The Middle Stone Age south of the Limpopo River. Journal of World Prehistory 6(4):385-431.

Tobias, P.V. 1979. Men, minds and hands: cultural awakenings over two million years of humanity. South African Archaeological Bulletin 34:85-92.

Tobias, P.V. 1998. Evidence for the early beginnings of spoken language. Viewpoint: the origins of speech. Cambridge Archaeological Journal 8(1):69-94.

Tsirk, A. 1979. Regarding fracture initiation. In: Hayden, B. (ed.) Lithic use-wear analysis:83-96. New York: Academic Press.

Trigger, B.G. 1989. A history of archaeological thought. Cambridge: Cambridge University Press.

Uylings, H.B.M. & Van Eden, C.G. 1990. Qualitative and quantitative comparison of the prefrontal cortex in rats and in primates, including humans. In: Uylings, H.B.M., De Bruin, J.P.C., Corner, M.A. & Feenstra, M.G.P. (eds) Progress in brain research:31-61. Amsterdam: Elsevier Science Publishers B.V. (Biomedical Division).

Van Peer, P. 1992. The Levallois reduction strategy. Monographs in world archaeology No. 13. Wisconsin: Prehistory Press.

Van Peer, P. 1995. Current issues in the Levallois Problem. In: Dibble, H.L. & Bar-Yosef, O. (eds) The definition and interpretation of Levallois Technology:1-10. Monographs in world archaeology No. 23. Wisconsin: Prehistory Press.

Van Peer, P. 1998. The Nile corridor and the Out-of-Africa model – an examination of the archaeological record. Current Anthropology 39 supplement:115-140.

Villa, P. 1991. From debitage chips to social models of production: the refitting method in Old World Archaeology. Review of Cziesla, E., Eickoff, S., Arts, N. & Winter, D. (eds) 1990. The big puzzle. International symposium on refitting stone artefacts Studies in modern archaeology Volume 1. Bonn:Holos Verlag. The review of archaeology 12(2):24-30.

Vogel, J.C. *in press.* Radiometric dates for the Middle Stone Age in South Africa. In: Proceedings of the Dual Congress held in 1998, Johannesburg.

Vogelsang, R. 1996. The Middle Stone Age in south-western Namibia. In: Pwiti, G. & Soper, R. (eds). Aspects of African Archaeology:207-212. Harare: University of Zimbabwe Publications.

Voigt, E.A. 1982. The molluscan fauna. In: Singer, R. & Wymer, J. The Middle Stone Age at Klasies River Mouth in South Africa:155-186. Chicago: University of Chicago Press.

Volman, T.P. 1981. The Middle Stone Age in the southern Cape. Chicago: University of Chicago, PhD thesis.

Volman, T.P. 1984. Early prehistory of southern Africa. In: Klein, R.G. (ed.) Southern African prehistory and palaeoenvironments:169-220. Rotterdam: Balkema.

Von Gernet, A. 1993. The construction of prehistoric ideation: exploring the universality-idiosyncrasy continuum. Cambridge Archaeological Journal 3(1):67-81.

Wadley, L. 1997. Rose Cottage Cave: Archaeological work 1987 to 1997. South African Journal of Science 93:439-444.

Wadley, L. & Harper, P. 1989. Rose Cottage cave revisited: Malan's Middle Stone Age collection. South African Archaeological Bulletin 44:23-32.

Wainscoat, J., Hill, A., Boyce, A., Flint, J., Hernandez, M., Thein, S.L., Old, J.M., Lynch, J.R., Falusi, Y., Weatherall, D.J. & Clegg, J.B. 1986. Evolutionary relationships of human populations from an analysis of nuclear DNA poymorphisms. Nature 319:491-493.

Watts, I. 1996. The origins of symbolic culture: The Southern African Middle Stone Age and Khoisan ethnography. London: University of London, Ph.D. Thesis.

Whallon, R. 1989. Elements of cultural change in the Later Palaeolithic. In: Mellars, P. and Stringer, C. (eds) The Human revolution: behavioural and biological perspectives on the origins of modern humans:433-454.. Edinburgh: Edinburgh University Press.

White, R. 1982. Rethinking the Middle-Upper Paleolithic transition. Current Anthropology 23:169-192.

Wiessner, P. 1983. Style and social information in Kalahari San projectile points. American Antiquity 48:253-276.

Wiessner, P. 1990. Is there a unity to style? In: Conkey, M. & Hastorf, C. (eds) The uses of style in archaeology:5-17. Cambridge: Cambridge University Press.

Wobst, H.M. 1977. Stylistic behaviour and information exchange. In: Cleland, C.E. (ed.) For the director: research essays in honor of James B. Griffin:317-342. University of Michigan Museum of Anthropology, Anthropological Papers 61.

Wolpoff, M.H. 1992. Theories of modern human origins. In: Bräuer, G. & Smith, F.H. (eds) Continuity or replacement: controversies in *Homo sapiens* evolution:25-54. Rotterdam: A.A. Balkema.

Wolpoff, M.H. & Caspari, R. 1990. Metric analysis of the skeletal material from Klasies River Mouth, Republic of South Africa. American Journal of Physical Anthropology 81:319.

Wood, J.T. 1992. Spinning the symbolic web – human communication and symbolic interaction. New Jersey: Ablex Publishing Corporation.

Wood, B. & Collard, M. 1999. The human genus. Science 284:65-71.

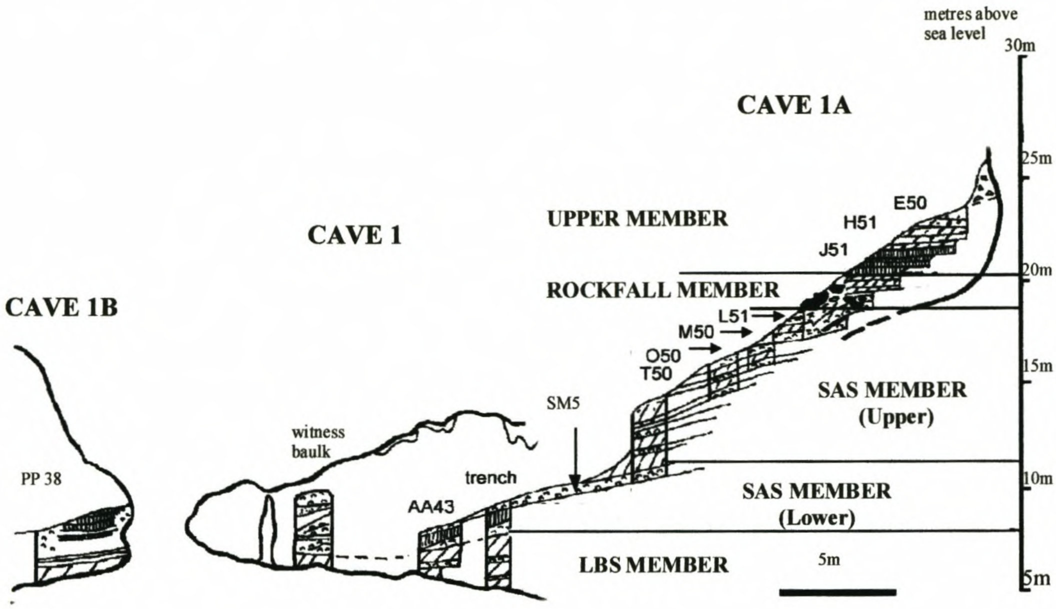
Wurz, S. 1997. The Howiesons Poort at Klasies River: from artefacts to cognition. Stellenbosch: University of Stellenbosch, Masters Thesis.

Wurz, S. 1999. The Howiesons Poort at Klasies River – an argument for symbolic behaviour. South African Archaeological Bulletin 54(69):38-50.

Yellen, J.E., Brooks, A.S, Cornelissen, E., Mehlman, M.J. & Stewart, K. 1995. A Middle Stone Age worked bone industry from Katanda, Upper Semliki Valley, Zaire. Science 268:553-6.

APPENDIX 1

SCHEME OF SECTIONS SHOWING UNITS AND MEMBERS



MSA lll HOWIESONS POORT MSA ll (upper) MSA lll (lower) MSA 1

CAVE 1A

E50

22.9m TSG
TSC
TSB
TSA
TSAS
TSAT
CP1
AT
AU
AV
AB
BSL
CP2
BSS1
BSS2

CP3			
BSS3			
CP4			
BSS5			
BS			
YS1			
YS2			
YS3			
CP5			
YS4			
CP6			
CP7			
CP8			
CP11			
CP12			
CP15			
CW			
CP16			
CP17	H51		
CP18	YS1		
	CP1		
	YS2		
	CP2		
	CP3		
	YS4		
	CP4		
	YS5		
	CP6AF1		
	CP7AF1		
	CP8		
	CP8AF!		
	YS6		
	CP10		
	CP11	J51	
	CP12	CPx1	
		YSx1	
		CPx2	
		YSx2	
		CPx4	
		YSx3	
		CPx5	
		YSx4	
		YSx5	
20m	Rockfall	Rockfall	
		L51	
		YS	
		SL1	
		FSS1	
		SL2	
		FS2	
		SL3	
		FS3	
		SL4	Donax midden
		FS4	

			SL5			
			SL6			
			J48			
			SM3			
			K48			
			CP1			
			TYS2			
			CP2			
			CP2AF1			
			YS3			
			YS4			
			SM1			
			YS5			
			SM3			
			SM2AF1			
			YS6			
			SM3			
			YS7			
			CP3			
			M50			
			YS			
			YSD			
			YS1			
				O50		
			SM1	SL2		
			SM2	SL2L		
				SL2L		
				SL3		
				SL3AF		
				BSP		
CAVE 1				SL4T		
A1				SL4CP		
B1				SL4M		
B2A				SL4MAF	P50	
B2B				BSQ/L	BS1	
B3				SL5		
J1				SL5AF1	SM1	
J2				SL5CP		
J3				SL5L		
J4				BS1	BS2	
J5				SL6		
J6				SL6CP	SM2	
H1				BS2		
H2				BS2S	BS3	
H3				SL7T		
D1				SL7M	SM3	T51
D2	AA43	Z44		SL7B		SL3
FMT		BS1		BS3T		
FMS		SM2		BS3		
FMB		BS2		BS3A		LBS

		FMB2		YS1		BS3B	SL4	T50
		SSM		YS1B	15m		SL4L	SM1
		SMB2	SM1	SCB2A			SL4M	
		TSM	BS1	SCB2B			SL4ML	
CAVE 1B		OHO	SM2	SCB2BCP			BS1	BS1
	8m	HHH	BS2	SCB3S			BS1L	
PP38				SCB3CP			SL5	SM2
YS1				SAS1S				BS2
BS1AF1	7.5 becrock		SCB1	SAS1SH				SM3
BS1AF1			YS1	SAS2S				BS3
YS2				SAS2SH				SM4
BS2			YS1B	SAS2S				BS4
BS3			SCB2	SAS2SHCP				BS4L
CP1			SCB3	SAS3S				SM5T
BS4			SAS1S	SAS4S				SM5T
BS5			SAS2SH	SAS4SHBH				SM5L
CP3			SAS3S	SAS4SHCH				SM5LB
BS6			SAS3SH					
CP4+5			SAS4S	SAS4SHCB				
CP6			SAS4SH	SAS4SHD				
CP7YSB1			SAS4SHB					
CP8			SAS4SH C	SBS				
CP9			SAS5S	SBSCP2				
CP10			SBS	Bedrock				
CP11								
YS1								
CP1								
YBS								
YBS3								
GBS								
BS								
CP2								
GBS2								
GBS2S								
RSYRU								
RSDRU								
RSYSH								
RSBCH								

Figure 39. Scheme of units and members.

Table 11. Grouping of layers into members at Klasies River main site

Sub-stage	Cave 1A		Cave 1		Cave 1B	
	Member	Layers	Member	Layer	Member	Layer
MSA 1ll	Upper	E50S-E50AB				
MSA 1ll	Upper	E50BSL-E50YS3				
Howiesons Poort	Upper	E50CP5-E50CP11				
Howiesons Poort	Upper	E50CP12-E50CP18				
Howiesons Poort	Upper	H51YS1-H51CP5/YS5				
Howiesons Poort	Upper	H51CP6-J51CPX1				
Howiesons Poort	Upper	J51YSX1-J51YSX6				
MSA 1l upper	SAS	L51 YS-J48 SM3	SASW	J4-J6		
MSA 1l upper	SAS	K48 CP1 - K48 CP3	SASW	H1-3		
MSA 1l upper	SAS	M50 YS - M50 SM2				
MSA 1l upper	SAS	O50 SL2- P50 BS1				
MSA 1l upper	SAS	O50 SL5 - T51 LBS			SAS	PP38 DCSURF - DCAF2
MSA 1l upper	SAS	T51 SL4 - T50 BS1			SAS	PP38 DCBS4 - DCBS6
MSA 1l upper	SAS	T51 SL5 - T50 BS4L			SAS	PP38 DCCP4 - DCCP6
MSA 1l lower	SAS	T50 SM5T - Y44 SM51SHB	SASU	D1-2	SAS	PP38 DCCP7 - DCCP7YBS2
MSA 1l lower	SAS	Y45 CL2 - AA 43 BS2	SASU	FMT-FMB	SAS	PP38 DCCP8 - DCYS3U
MSA 1l lower	SAS	Y44 SCB1 - AA43 SCB2AS	SASU	FMB2 -TSM	SAS	PP38 DCCP9GS - DCYS4
			SASU	OHO-HHH	SAS	PP38 DCCP10BP - DCCP12BL
			(SASL)			
			(SASR)			
MSA 1	LBS	Z44 SCB3S - AA43 SASSH			LBS	PP38 RSYS1T - RSGBS2B
MSA 1	LBS	Z44 SAS2S - AA 43 SAS4SHB				
MSA 1	LBS	Z44 SAS4SHC - AA43 SBS				

CORE CATEGORIES

a) Prepared or Levallois-type cores: (i) **Blade** cores (ii) **Point** cores (These are discussed in detail in Chapter 5).

b) **Preforms** are cobbles or large pieces with a few large flakes struck of one surface that have not been developed further.

c) The term **'micro-cores'** was coined by Singer & Wymer (1982:91). Microcores are cores that are smaller than 5 cm in diameter (Singer & Wymer include small cores in this category). A characteristic of the microcores is that they have been worked down to such an extent that they have lost much of the information they carry on technique and method of flake production. They are essentially core reduced pieces and reflect the late stage of discard in working materials, primarily silcrete. This category has been included to allow comparison with the SW-sample.

d) **Irregular**/indeterminate cores are associated with hinge fractures and represent an early discard stage in core reduction.

e) **Core fragments** are pieces with core characteristics which broke off cores. The breakage is along fracture lines in the material. The fracture line is visible and is often part of a cone. This is the most numerous class.

e) **'Bladelet'** cores carry bladelet scars. They occur in very low frequencies and show no systematic preparation of the platform. For these reasons they are considered opportunistic. They are most often on core-fragments. This category has been included to allow comparison with the SW-sample.

f) ***Outils écaillés.*** Singer & Wymer regarded this class as a tool type with a purpose, possibly 'chisel adzes'. As discussed elsewhere they are more probably core-reduced pieces.

The amount and position of cortex remaining on the cores, were noted (Table 12).

Table 12. Amount of cortex on cores

1	**Whole undersurface**
2	**Less than half of undersurface**
3	**No**
4	**Cortex on whole under & part of upper surface**

PLATFORM ATTRIBUTES

Platform size in terms of maximum length and maximum width, lipping, the prominence of the bulb and the exterior platform angle were noted (Fig. 40). The angle between the platform and the dorsal surface is regarded as a key variable, but is difficult to measure with precision. Due to the difficulties associated with measuring platforms, the platform angle measurements are measured in increments of 10 mm.

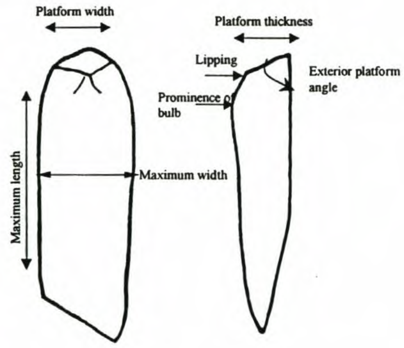


Figure 40. Diagram of the ventral and lateral view of a blade showing platform attributes.

The platforms are classed into 'soft hammer' and 'hard hammer'. The definitive elements of 'soft hammer' platforms are a diffused bulb and lipping. 'Soft hammer' platforms are further categorised into plain soft hammer, convex faceted and planar faceted. The hard hammer platforms have well developed bulbs and no lipping was observed. Hard hammer platforms are categorized into plain hard hammer, planar faceted, convex faceted and informally faceted. Another category is shattered platforms.

These platform categories correspond to those used by Thackeray & Kelly (1988) in the following way (Table 13).

Table 13. Terminology used in describing platforms

This study	Thackeray & Kelly 1988
Plain	Plain Flat
Planar faceted	Plain Flat
Convex faceted	Peaked Rounded
Shattered	Shattered
Irregular	Irregular

DORSAL SCAR PATTERNING ON BLANKS.

The patterning on the dorsal face of the pieces are noted (Fig. 41).

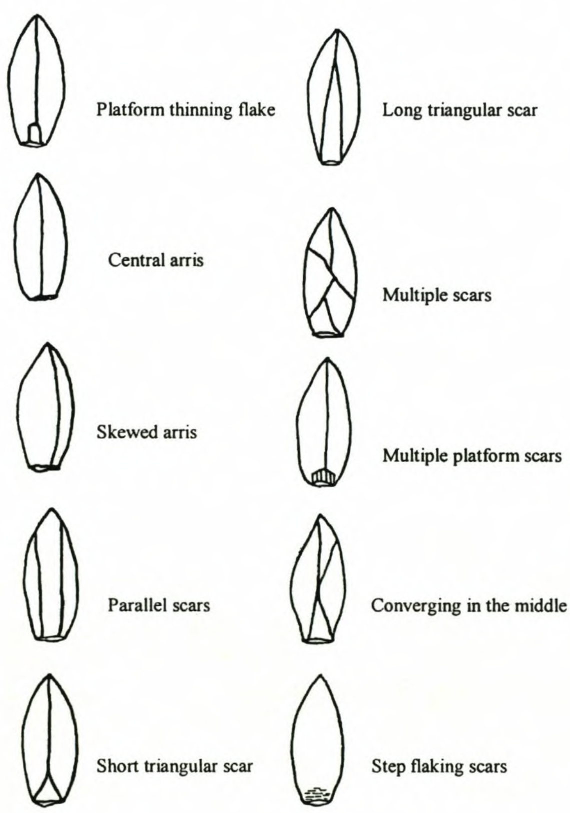


Figure 41. Dorsal scar pattern categories.

ASSEMBLAGE COMPOSITION

Table 14. Assemblage composition of D-sample, cave 1 (SASW & SASU sub-members)

	OHO-HHH		FMB2-TSM		FMT-FMB		D1-D2		H1-H3		J4-B1	
	%	n	%	n	%	n	%	n	%	n	%	n
Cores	**1.2**	31	**1.8**	33	**1.5**	24	**0.4**	7	**0.0**	0	**0.0**	0
Chips	**26.4**	659	**16.6**	306	**8.9**	143	**12.6**	222	**25.7**	226	**41.5**	444
Chunks	**0.2**	6	**0.2**	4	**0.6**	9	**2.2**	39	**1.6**	14	**2.4**	26
Flakes	**62.6**	1562	**68.1**	1258	**69.0**	1103	**63.9**	1123	**70.5**	621	**60.9**	652
Blade sections	**5.4**	135	**7.8**	145	**11.5**	184	**11.2**	197	**13.1**	115	**16.2**	173
Blades	**2.4**	61	**3.2**	59	**4.5**	72	**4.4**	78	**7.8**	69	**9.1**	97
Points	**3.0**	74	**4.1**	76	**5.4**	87	**5.6**	99	**7.0**	62	**11.4**	122
Total	**100.0**	2497	**100.0**	1848	**100.0**	1598	**100.0**	1758	**100.0**	881	**100.0**	1070

Table 15. Assemblage composition of D-sample, cave 1A (SAS member)

	AA43 SCB2AS- AA43 SBS		AA43 SM1- AA43 SCB2		T50 SM5T-T50 SM5LB		T50 SM1-T50 BS4L		P50 BS1-T51 SL4M		J48 SM3-O50 SI5CP		E50 CP5-J51 YSx5		E50 S-E50 YS3	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Cores	**0.4**	9	**1.6**	17	**0.4**	3	**0.7**	4	**0.0**	0	**0.4**	18	**0.2**	30	**0.2**	9
Chips	**41.9**	969	**36.5**	391	**40.7**	346	**35.2**	212	**33.9**	227	**44.6**	2271	**60.9**	8479	**66.5**	3294
Chunks	**4.0**	92	**2.7**	29	**5.8**	49	**5.0**	30	**11.6**	78	**1.9**	98	**1.2**	173	**1.3**	64
Irregular flakes	**31.7**	734	**29.1**	312	**35.9**	305	**36.9**	222	**30.9**	207	**37.3**	1899	**21.9**	3043	**18.3**	909
Blade sections	**16.3**	378	**17.9**	192	**11.5**	98	**16.3**	98	**22.2**	149	**12.5**	637	**1.2**	163	**12.5**	621
Blades	**4.3**	99	**8.9**	95	**3.6**	31	**3.8**	23	**0.6**	4	**2.1**	108	**14.6**	2026	**0.8**	42
Points	**1.0**	24	**2.7**	29	**1.4**	12	**1.3**	8	**0.1**	1	**1.0**	53	**0.0**	0	**0.3**	16
Total	**100**	2313	**100**	1072	**100**	850	**100**	602	**100**	670	**100**	5087	**100**	13916	**100**	4956

APPENDIX 2

RAW MATERIAL

Table 16. Non-local raw material usage in cave 1A, MSA lll – MSA l, D-sample, cave 1A

Cultural designation (layer in brackets)	% (non-q.zite)	n (non-q.zite)	n (total)
MSA 1ll (1)	**5.1**	106	2083
MSA 1ll (2)	**6.8**	198	2910
Howiesons Poort (3)	**22.5**	279	1242
Howiesons Poort (4)	**59.2**	1024	1729
Howiesons Poort (5)	**38.5**	1023	2658
Howiesons Poort (6)	**34.4**	722	2099
Howiesons Poort (7)	**12.4**	308	2482
Upper MSA 1l (8)	**0.3**	3	1127
Upper MSA 1l (9)	**0.3**	4	1221
Upper MSA 1l (10)	**0.2**	4	1945
Upper MSA 1l (11)	**2.8**	38	1367
Upper MSA 1l (12)	**1.1**	22	1996
Upper MSA 1l (13)	**3.4**	142	4202
Upper MSA 1l (14)	**5.7**	59	1042
Lower MSA 1l (15)	**0.8**	9	1084
Lower MSA 1l (16)	**0.6**	25	4216
Lower MSA 1l (17)	**0.3**	13	4154
MSA 1 (18)	**0.2**	4	2231
MSA 1 (19)	**0.1**	4	3631
MSA 1 (20)	**0.3**	11	4082
n =		3998	47501

Table 17. Non-local raw material usage MSA I – MSA III, D-sample

(*cave 1, #cave 1B)

Cave	Cultural designation	Layers	% (non-q.zite)	n (non-q.zite)	n (total)
1A	**MSA III (1)**	E50S-E50AB	**5.1**	**106**	**2083**
1A	**MSA III (2)**	E50BSL-E50YS3	**6.8**	**198**	**2910**
1A	**Howiesons Poort (3)**	E50CP5-E50CP11	**22.5**	**279**	**1242**
1A	**Howiesons Poort (4)**	E50CP12-E50CP18	**59.2**	**1024**	**1729**
1A	**Howiesons Poort (5)**	H51YS1-H51CP5/YS5	**38.5**	**1023**	**2658**
1A	**Howiesons Poort (6)**	H51CP6-J51CPX1	**34.4**	**722**	**2099**
1A	**Howiesons Poort (7)**	J51YSX1-J51YSX6	**12.4**	**308**	**2482**
1A	**MSA II upper (8)**	L51 YS-J48 SM3	**0.3**	**3**	**1127**
1A	**MSA II upper (9)**	K48 CP1 - K48 CP3	**0.3**	**4**	**1221**
1A	**MSA II upper (10)**	M50 YS - M50 SM2	**0.2**	**4**	**1945**
1A	**MSA II upper (11)**	O50 SL2- P50 BS1	**2.8**	**38**	**1367**
1A	**MSA II upper (12)**	O50 SL5 - T51 LBS	**1.1**	**22**	**1996**
1A	**MSA II upper (13)**	T51 SL4 - T50 BS1	**3.4**	**142**	**4202**
1A	**MSA II upper (14)**	T51 SL5 - T50 BS4L	**5.7**	**59**	**1042**
1	**MSA II upper (15)**	B1-3 - H1-3	**8.8**	**60**	**685**
1	**MSA II upper (12*)**	J4-J6	**4.1**	**35**	**850**
1	**MSA II upper (13*)**	H1-3	**3.8**	**43**	**1119**
1A	**MSA II lower (15)**	T50 SM5T - Y44 SM51SHB	**0.8**	**9**	**1084**
1-1A	**MSA II lower (16)**	Y45 CL2 - AA 43 BS2	**0.6**	**25**	**4216**
1-1A	**MSA II lower (17)**	Y44 SCB1 - AA43 SCB2AS	**0.3**	**13**	**4154**
1	**MSA II lower (14*)**	D1-2	**2.6**	**46**	**1792**
1	**MSA II lower (15*)**	FMT-FMB	**2.0**	**32**	**1631**
1	**MSA II lower (16*)**	FMB2 -TSM	**0.5**	**10**	**1896**
1	**MSA II lower (17*)**	OHO-HHH	**0.4**	**10**	**2522**
1B	**MSA II lower (22#)**	PP38 DCSURF - DCAF2	**0.1**	**1**	**1684**
1B	**MSA II lower (23#)**	PP38 DCBS4 - DCBS6	**0.7**	**11**	**1662**
1B	**MSA II lower (24#)**	PP38 DCCP4 - DCCP6	**1.2**	**27**	**2217**
1B	**MSA II lower (25#)**	PP38 DCCP7 - DCCP7YBS2	**1.4**	**21**	**1491**
1B	**MSA II lower (26#)**	PP38 DCCP8 - DCYS3U	**0.9**	**38**	**4300**
1B	**MSA II lower (27#)**	PP38 DCCP9GS - DCYS4	**0.3**	**11**	**3638**
1B	**MSA II lower (28#)**	PP38 DCCP10BP - DCCP12BL	**0.3**	**4**	**1455**
1-1A	**MSA I (18)**	Z44 SCB3S - AA43 SASSH	**0.2**	**4**	**2231**
1-1A	**MSA I (19)**	Z44 SAS2S - AA 43 SAS4SHB	**0.1**	**4**	**3631**
1-1A	**MSA I (20)**	Z44 SAS4SHC - AA43 SBS	**0.3**	**11**	**4082**
1B	**MSA I (29#)**	PP38 RSYS1T - RSGBS2B	**0.1**	**2**	**1813**
n =				**4349**	**76256**

Layer numbers used in Figures 12 & 42 in brackets

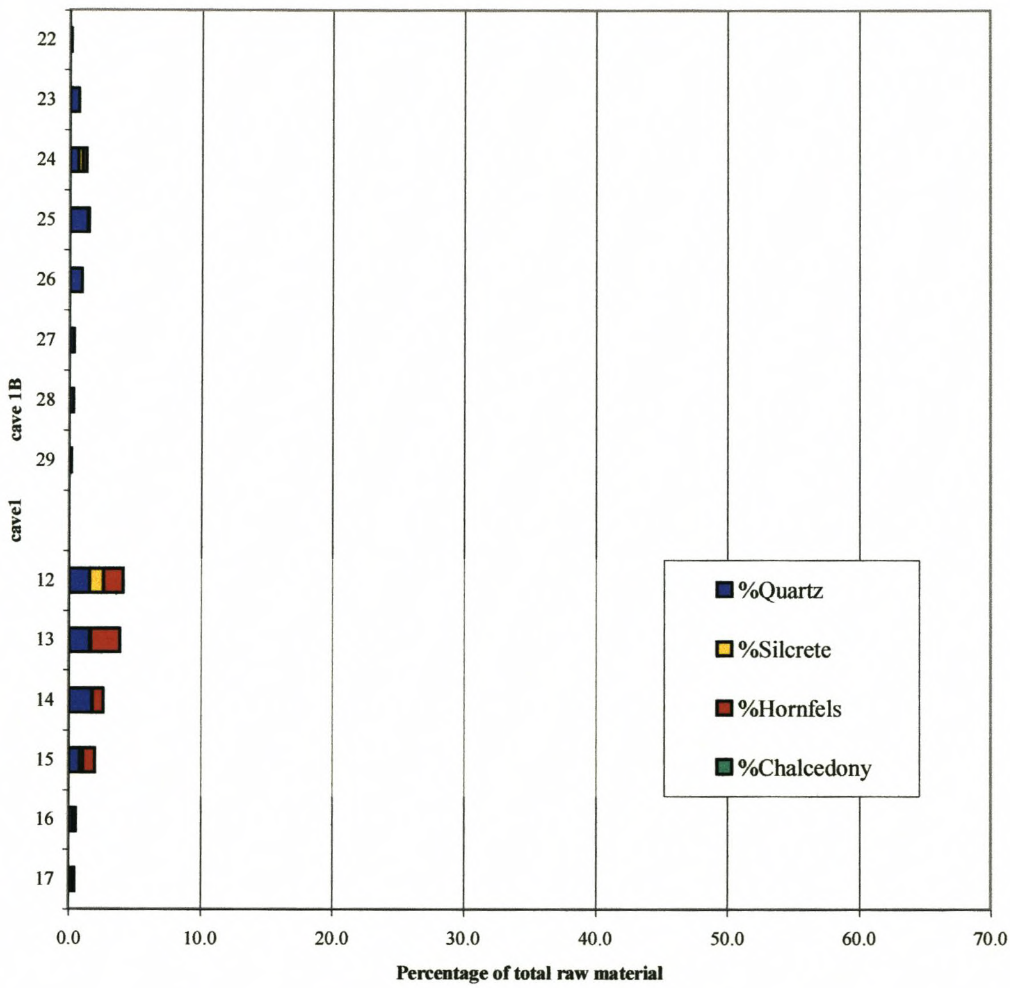


Figure 42. Non-local raw material used in cave 1 and cave 1B, D-sample.

For layer numbers, see Table 17, Appendix 2.

Method of artefact production: core data

MSA 1

Table 18. Core types, MSA I, SW-sample

Type	%	n
Point	**35**	34
Blade	**18**	18
Irregular	**4**	4
Core fragm.	**38**	37
Preform	**5**	5
n =	**100**	98

Table 19. Descriptive statistics of point and blade cores, MSA I, SW-sample

	Point cores			Blade cores		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**65.5**	**57.6**	**29.1**	**63.2**	**64.4**	**27.2**
SD	**12.9**	**9.3**	**7.8**	**13.6**	**13.1**	**11.3**
CV	**20**	**16**	**27**	**22**	**20**	**41**
Min.	**46**	**42**	**16**	**43**	**48**	**15**
Max.	**112**	**76**	**49**	**96**	**85**	**68**
n =	**34**	**34**	**34**	**18**	**18**	**18**

Table 20. Cortex on MSA I cores, SW-sample

	%	n
Majority of undersurface	**18**	18
Part of undersurface	**31**	30
No cortex	**51**	50
Total	**100**	98

Table 21. Platform angles on MSA l cores, SW-sample

	Point cores				Blade cores			
	Prox. angle		**Distal angle**		**Prox. Angle**		**Distal angle**	
Angle	**%**	n	**%**	n	**%**	n	**%**	n
0-30	**0**	0	**50**	2	**0**	0	**38**	5
31-40	**6**	2	**0**	0	**6**	1	**23**	3
41-50	**0**	0	**0**	0	**17**	3	**8**	1
51-60	**9**	3	**25**	1	**17**	3	**0**	0
61-70	**21**	8	**0**	0	**39**	7	**8**	1
71-80	**42**	14	**0**	0	**22**	4	**23**	3
81-90	**21**	7	**25**	1	**0**	0	**0**	0
n=	**100**	34	**100**	4	**100**	18	**100**	13

MSA ll

Table 22. Core types, MSA ll, D-sample

Type	Lower MSA 11		Upper MSA 11	
	%	n	%	n
Point	**48**	67	**33**	13
Blade	**8**	11	**13**	5
Irregular	**7**	10	**3**	1
Core fragm.	**36**	51	**49**	19
Preform	**1**	2	**3**	1
n =	**100**	141	**100**	39

Table 23. Descriptive statistics of point and blade cores, lower MSA ll, D-sample

	Point cores			Blade cores		
	Length	**Width**	**Thickn**	**Length**	**Width**	**Thickn.**
Mean	**65.1**	**62.6**	**28.5**	**59.8**	**58.3**	**27.7**
SD	**14.7**	**11.9**	**8.2**	**14.3**	**8.2**	**7.4**
CV	**23**	**19**	**29**	**24**	**14**	**27**
Min.	**37**	**33**	**15**	**40**	**43**	**16**
Max.	**122**	**96**	**61**	**90**	**69**	**40**
n =	**67**	**67**	**67**	**11**	**11**	**11**

Table 24. Descriptive statistics of point and blade cores, upper MSA II, D-sample

	Point cores			Blade cores		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**59.8**	**58.3**	**27.7**	**61**	**62.6**	**27.6**
SD	**14.3**	**8.2**	**7.4**	**17.5**	**26.1**	**8.8**
CV	**24**	**14**	**27**	**29**	**42**	**32**
Min.	**40**	**43**	**16**	**44**	**33**	**13**
Max.	**90**	**69**	**40**	**88**	**102**	**35**
n =	**13**	**13**	**13**	**5**	**5**	**5**

Table 25. Cortex on MSA II lower and MSA II upper cores, D-sample

	Lower MSA ll		Upper MSA ll	
	%	n	**%**	n
Majority of undersurface	**40**	56	**21**	8
Part of undersurface	**22**	31	**26**	10
No cortex	**37**	52	**54**	21
Upper and undersurface	**1**	2	**0**	0
Total	**100**	141	**100**	39

Table 26. Platform angles on point and blade cores, lower MSA II, D-sample

Angle	Point cores				Blade cores			
	Prox. Angle		**Distal angle**		**Prox. angle**		**Distal angle**	
	%	n	**%**	n	**%**	n	**%**	n
0-30	**3**	2	**13**	4	**0**	0	**0**	0
31-40	**4**	3	**9**	3	**9**	1	**20**	1
41-50	**7**	5	**16**	5	**0**	0	**0**	0
51-60	**21**	14	**19**	6	**9**	1	**20**	1
61-70	**31**	21	**19**	6	**18**	2	**20**	1
71-80	**12**	8	**9**	3	**36**	4	**0**	0
81-90	**21**	14	**16**	5	**27**	3	**40**	2
n =	**100**	67	**100**	32	**100**	11	**100**	5

Table 27. Platform angles on point and blade cores, upper MSA II, D-sample

Angle	Point cores				Blade cores			
	Prox. Angle		**Distal angle**		**Prox. angle**		**Distal angle**	
	%	n	**%**	n	**%**	n	**%**	n
0-30	**0**	0	**33**	1	**0**	0	**0**	0
31-40	**0**	0	**0**	0	**0**	0	**0**	0
41-50	**0**	0	**67**	2	**20**	1	**0**	0
51-60	**15**	2	**0**	0	**20**	1	**0**	0
61-70	**23**	3	**0**	0	**20**	1	**100**	1
71-80	**38**	5	**0**	0	**40**	2	**0**	0
81-90	**23**	3	**0**	0	**0**	0	**0**	0
n =	**100**	13	**100**	3	**100**	5	**100**	1

HOWIESONS POORT

Table 28. Core types, Howiesons Poort, SW-sample and D-sample (cave 1A & 2)

Core types	SW-sample		D-sample, (cave 1A)		D-sample, (cave 2)	
	%	n	**%**	n	**%**	n
Blade	**49**	186	**47**	15	**34**	22
Irregular	**11**	45	**3**	1	**15**	10
Core fragm.	**24**	103	**44**	14	**51**	33
Preform	**7**	31	**3**	1	**0**	0
'Bladelet'	**2**	7	**3**	1	**0**	0
'Microcore'	**7**	28	**0**	0	**0**	0
n =	**100**	400	**100**	42	**100**	65

Table 29. Types of Howiesons Poort cores by raw material, SW-sample

Core types	Quartzite		Silcrete		Milky quartz		Glassy quartz		Chalcedony		Hornfels	
	%	n	%	n	%	n	%	n	%	n	%	n
Blade	**60**	126	**36**	46	**12**	4	**100**	1	**100**	2	**64**	7
Irregular	**6**	16	**2**	3	**79**	26	**0**	0	**0**		**0**	0
Core fragm.	**19**	45	**40**	51	**9**	3	**0**	0	**0**		**36**	4
Preform	**12**	30	**0**	0	**0**	0	**0**	0	**0**		**0**	0
'Bladelet'	**0**	0	**6**	7	**0**	0	**0**	0	**0**		**0**	0
'Microcore'	**3**	7	**16**	21	**0**	0	**0**	0	**0**		**0**	0
n =	**100**	224	**100**	128	**100**	33	**100**	1	**100**	2	**100**	11

Table 30. Descriptive statistics of blade cores, Howiesons Poort, SW-sample, D-sample (cave 1A and cave 2)

	SW- sample			D-sample, cave 1A			D-sample, cave 2		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**43.8**	**44.1**	**21.2**	**36.3**	**37.1**	**20.6**	**50.9**	**44.9**	**23.1**
SD	**11.5**	**10.5**	**7.7**	**12.6**	**16.5**	**8.2**	**12.2**	**8.4**	**5.8**
CV	**26**	**24**	**42**	**35**	**45**	**40**	**24**	**18**	**24**
Min.	**17**	**15**	**5**	**19**	**21**	**9**	**26**	**28**	**13**
Max.	**90**	**81**	**50**	**64**	**74**	**36**	**78**	**59**	**38**
n =	**186**	**186**	**186**	**15**	**15**	**15**	**22**	**22**	**22**

Table 31. Descriptive statistics of blade cores in quartzite and non-quartzite, Howiesons Poort, SW-sample

	Quartzite cores			Non-quartzite cores		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**47.4**	**47.6**	**21.5**	**36.3**	**36.7**	**15.2**
SD	**11.2**	**9.8**	**8.1**	**8.2**	**8.0**	**5.7**
CV	**23**	**20**	**39**	**22**	**21**	**37**
Min.	**30**	**29**	**5**	**17**	**15**	**5**
Max.	**90**	**81**	**50**	**68**	**60**	**35**
n =	**126**	**126**	**126**	**60**	**60**	**60**

Table 32. Cortex on Howiesons Poort blade cores SW-sample

Cortex	%	n
Majority of undersurface	**24**	46
Part of undersurface	**32**	60
No cortex	**44**	80
Total	**100**	186

Table 33. Platform angles on Howiesons Poort blade cores, SW-sample

Platform angle	Prox. angle		Dist. angle	
	%	n	%	n
0- 30	**4**	7	**7**	12
31-40	**6**	12	**53**	86
41-50	**22**	40	**17**	28
51-60	**34**	64	**9**	14
61-70	**18**	33	**9**	14
71-80	**8**	14	**6**	9
81-90	**9**	16	**0**	0
Total	**100**	186	**100**	163

MSA lll

Table 34. Core types, MSA lll, D-sample

	%	n
Point	**0**	0
Blade	**27**	3
Irregular	**27**	3
Core fragm.	**45**	5
Preform	**0**	0
n =	**100**	11

Blank production: technique and description

MSA 1

PLATFORMS

Table 35. Platform type, blades and points, MSA l, D-sample

Platform type	Blades		Points	
	%	n	%	n
Soft hammer:				
Plain	**24**	77	**6**	4
Planar faceted	**15**	50	**7**	5
Convex faceted	**2**	6	**0**	0
Hard hammer:				
Plain	**17**	54	**16**	11
Planar faceted	**19**	60	**40**	28
Convex faceted	**20**	66	**30**	21
Shattered	**0**	1	**1**	1
Informal faceted	**3**	10	**0**	0
n =	**100**	324	**100**	70

Table 36. Platform preparation, blades and points, MSA l, D-sample

Platform preparation	Blades		Points	
	%	n	%	n
Rubbing	**19**	61	**13**	9
Step flaking	**6**	20	**8**	6
Rubbing & step flaking	**11**	36	**13**	9
None	**64**	206	**66**	46
n =	**100**	323	**100**	70

Table 37. Descriptive statistics, platforms of blades and points, MSA l, D-sample

	Blades		Points	
	Plwidth	**Plthickn.**	**Plwidth**	**Plthickn.**
Mean	**19.6**	**6.8**	**25.3**	**8.6**
SD	**6.6**	**3.0**	**5.8**	**2.8**
CV	**34**	**44**	**23**	**32**
Min.	**3**	**1**	**12**	**1**
Max.	**42**	**21**	**37**	**15**
n =	**323**	**323**	**70**	**70**

Table 38. Descriptive statistics, of blade 'soft hammer' platforms, MSA l, D-sample

	Plwidth	**Plthickn.**
Mean	**15.8**	**4.8**
SD	**5.7**	**2.1**
CV	**36**	**43**
Min.	**2**	**1**
Max.	**34**	**11**
n =	**133**	**133**

Table 39. Platform angles, blades and points, MSA l, D-sample

Platform	Blades		Points	
angle	**%**	n	**%**	n
81-90	**55**	178	**59**	41
71-80	**28**	92	**39**	27
61-70	**11**	35	**1**	1
51-60	**6**	17	**0**	0
41-50	**0**	0	**1**	1
31-40	**0**	0	**0**	0
21-30	**0**	1	**0**	0
11-20	**0**	0	**0**	0
0-9	**0**	0	**0**	0
n =	**100**	323	**100**	70

BLANK DESCRIPTION

Table 40. Descriptive statistics of blades, MSA l, D-sample

	Length	Width	Thickn.
Mean	**81.0**	**28.3**	**8.2**
SD	**23.4**	**8.2**	**3.5**
CV	**29**	**29**	**42**
Min.	**46**	**10**	**3**
Max.	**150**	**56**	**28**
n =	**84**	**472**	**472**

Table 41. Descriptive statistics of points, MSA l, D-sample

	Length	Width	Thickn.
Mean	**70.6**	**33.5**	**9.3**
SD	**15.9**	**6.1**	**2.3**
CV	**23**	**18**	**24**
Min.	**42**	**22**	**5**
Max.	**114**	**50**	**15**
n =	**60**	**71**	**71**

Table 42. Descriptive statistics, large and variable blades, MSA l, D-sample

	Variable blades			Large blades		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	80.0	27.8	8.1	**120**	**44.1**	**13.3**
SD	22.8	7.8	3.3	**14.1**	**5.8**	**4.2**
CV	29	28	40	**12**	**13**	**31**
Min.	46	10	3	**110**	**36**	**6**
Max.	150	56	28	**130**	**55**	**21**
n =	82	457	457	**2**	**15**	**15**

Table 43. Descriptive statistics, soft-hammer blades, MSA I, D-sample

	Length	Width	Thickn.
Mean	**77.7**	**28.8**	**7.7**
SD	**23.2**	**8.5**	**3.1**
CV	**30**	**30**	**41**
Min.	**13**	**5**	**3**
Max.	**114**	**49**	**28**
n =	**37**	**133**	**133**

Table 44. Dorsal scar patterning, blades and points, MSA I, D-sample

Dorsal scar pattern	**blades**		**points**	
	%	n	**%**	n
Platform thinning flake	**6**	18	**9**	6
Central arris	**35**	103	**21**	15
Small triangular	**19**	58	**37**	25
Long triangular	**4**	13	**20**	14
Multiple scars	**31**	91	**13**	10
Parallel	**0**	1	**0**	0
Multiple platform	**5**	14	**0**	0
Converging in middle	**0**	0	**0**	0
n =	**100**	298	**100**	70

MSA II

PLATFORMS

Table 45. Platform type, blades and points, upper and lower MSA II, D-sample

Platform type	Lower MSA 11				Upper MSA 11			
	Blades		**Points**		**Blades**		**Points**	
	%	n	%	n	%	n	%	n
Soft hammer:								
Plain	**3**	34	**0**	2	**8**	52	**0**	1
Planar faceted	**0**	3	**0**	0	**0**	1	**0**	0
Convex faceted	**0**	0	**0**	0	**0**	0	**0**	0
Hard hammer:								
Plain	**28**	383	**16**	86	**21**	141	**7**	21
Planar faceted	**24**	325	**44**	234	**32**	211	**46**	134
Convex faceted	**29**	396	**34**	179	**33**	218	**45**	132
Shattered	**1**	20	**1**	6	**2**	11	**0**	1
Informal faceted	**15**	197	**5**	26	**5**	32	**2**	5
Total	**100**	1358	**100**	533	**100**	666	**100**	294

Table 46. Descriptive statistics, platforms of blades and points, lower and upper MSA II, D-sample

	Lower MSA 11				Upper MSA 11			
	Blades		**Points**		**Blades**		**Points**	
	Plwidth	**Plthickn.**	**Plwidth**	**Plthickn.**	**Plwidth**	**Plthickn.**	**Plwidth**	**Plthickn.**
Mean	**24.5**	**10.0**	**29.7**	**11.3**	**21.4**	**9.2**	**27.2**	**10.4**
SD	**7.8**	**3.4**	**7.7**	**3.0**	**7.7**	**4.7**	**7.4**	**2.8**
CV	**32**	**34**	**26**	**27**	**36**	**51**	**27**	**27**
Min.	**5**	**1**	**12**	**3**	**3**	**0.5**	**6**	**2**
Max.	**59**	**27**	**76**	**25**	**57**	**70**	**50**	**21**
n =	**1338**	**1338**	**527**	**527**	**655**	**655**	**293**	**293**

Table 47. Platform angles, blades and points, upper and lower MSA ll, D-sample

Platform angle	Lower MSA ll				Upper MSA ll			
	Blades		**Points**		**blades**		**Points**	
	%	n	%	n	%	n	%	n
81-90	**68**	908	**76**	399	**64**	419	**66**	193
71-80	**27**	375	**21**	108	**26**	167	**27**	80
61-70	**4**	47	**3**	17	**9**	59	**5**	14
51-60	**1**	8	**0**	2	**1**	7	**2**	6
41-50	**0**	0	**0**	0	**0**	3	**0**	0
31-40	**0**	0	**0**	1	**0**	0	**0**	0
21-30	**0**	0	**0**	0	**0**	0	**0**	0
11-20	**0**	0	**0**	0	**0**	0	**0**	0
0-9	**0**	0	**0**	0	**0**	0	**0**	0
	100	1338	**100**	527	**100**	655	**100**	293

BLANK DESCRIPTION

Table 48. Descriptive statistics, blades, lower and upper MSA ll, D-sample

	Lower MSA 11			Upper MSA 11		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**75.9**	**30.2**	**9.6**	**68.8**	**26.9**	**8.7**
SD	**23.4**	**8.8**	**3.6**	**22.4**	**8.5**	**3.4**
CV	**31**	**29**	**38**	**32**	**32**	**39**
Min.	**26**	**10**	**3**	**23**	**9**	**2**
Max.	**170**	**72**	**33**	**145**	**63**	**25**
n =	**454**	**1791**	**1791**	**244**	**1074**	**1074**

Table 49. Descriptive statistics, points, lower and upper MSA ll, D-sample

	Lower MSA 11			Upper MSA 11		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**65.3**	**34.6**	**11.0**	**58.8**	**31.6**	**10.3**
SD	**16.6**	**7.7**	**3.9**	**15.8**	**7.2**	**2.9**
CV	**25**	**22**	**36**	**27**	**23**	**28**
Min.	**34**	**10**	**4**	**22**	**16**	**4**
Max.	**130**	**65**	**60**	**130**	**64**	**20**
n =	**414**	**545**	**545**	**246**	**298**	**298**

Table 50. Descriptive statistics, large and variable blades, lower and upper MSA ll, D-sample, sub-members SASW and SASU

	Lower MSA ll (SASU)						Upper MSA ll (SASW)					
	Variable blades			Large blades			Variable blades			Large blades		
	Length	Width	Thickn.	**Length**	**Width**	**Thickn.**	Length	Width	Thickn.	**Length**	**Width**	**Thickn.**
Mean	71.7	31.1	9.6	**106.9**	**44.3**	**15.1**	66.7	25.9	8.8	**98.9**	**38.5**	**13.8**
SD	18.0	8.4	3.0	**22.2**	**8.6**	**3.8**	21.3	8.2	3.3	**23.8**	**10.6**	**3.2**
CV	25	26	32	**21**	**19**	**25**	32	32	38	**24**	**27**	**23**
Min.	36	13	3	**63**	**20**	**10**	20	6	2	**50**	**16**	**8**
Max.	145	63	23	**156**	**72**	**33**	120	58	30	**145**	**58**	**25**
n =	209	683	683	**35**	**128**	**128**	136	357	357	**25**	**45**	**45**

Table 51. Dorsal scar patterning, blades and points, lower and upper MSA ll, D-sample

Dorsal scar pattern	Lower MSA 11				Upper MSA 11			
	Blades		**Points**		**Blades**		**Points**	
	%	n	**%**	n	**%**	n	**%**	n
Platform thinning flake	**9**	107	**12**	64	**8**	50	**6**	18
Central arris	**33**	401	**21**	111	**39**	244	**27**	77
Small triangular	**21**	250	**38**	200	**18**	114	**41**	114
Long triangular	**6**	68	**19**	99	**4**	24	**13**	38
Multiple s	**0**	5	**7**	35	**1**	5	**2**	6
Parallel	**23**	282	**0**	0	**21**	136	**7**	21
Multiple platform	**6**	67	**3**	17	**7**	41	**2**	7
Converging in middle	**2**	18	**0**	2	**2**	11	**2**	5
n =	**100**	1198	**100**	528	**100**	625	**100**	286

HOWIESONS POORT

PLATFORMS

Table 52. Platform type, blades, Howiesons Poort, D-sample (cave 1A)

Platform type	**%**	n
Soft hammer:		
Plain	**72**	280
Planar faceted	**3**	12
Convex faceted	**12**	45
Hard hammer:	**0**	0
Plain	**8**	33
Planar faceted	**1**	2
Convex faceted	**1**	5
Shattered	**2**	6
Informal faceted	**1**	5
n =	**100**	388

Table 53. Platform preparation, blades, Howiesons Poort, D-sample (cave 1A)

	%	n
Rubbing	**0**	0
Step flaking	**14**	54
Both	**0**	0
Thin flake(s)	**2**	8
None	**84**	321
n =	**100**	383

Table 54. Descriptive statistics, platforms, blades, Howiesons Poort, D-sample (cave 1A)

	Plwidth	Plthickn.
Mean	**11.6**	**3.7**
SD	**4.8**	**2.3**
CV	**41**	**61**
Min.	**1**	**1**
Max.	**30**	**12**
n =	**383**	**383**

Table 55. Platform angles, Howiesons Poort blades, D-sample (cave 1A)

	%	n
81-90	**42**	161
71-80	**25**	96
61-70	**21**	81
51-60	**9**	33
41-50	**2**	9
31-40	**1**	3
21-30	**0**	0
11-20	**0**	0
0-9	**0**	0
n =	**100**	383

BLANK DESCRIPTION

Table 56. Descriptive statistics, blades, Howiesons Poort, D-sample, cave 1A

	Length	Width	Thickn.
Mean	**43.9**	**18.8**	**4.9**
SD	**12.8**	**5.7**	**2.0**
CV	**29**	**30**	**40**
Min.	**22**	**5**	**0.5**
Max.	**78**	**44**	**14**
n =	**75**	**714**	**714**

Table 57. Descriptive statistics, quartzite and non-quartzite blades, Howiesons Poort, D-sample, cave 1A

	Quartzite blades			Non-quartzite blades		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**47.9**	**20.0**	**5.2**	**37.7**	**16.1**	**4.3**
SD	**11.0**	**5.6**	**2.0**	**13.0**	**5.0**	**1.8**
CV	**23**	**28**	**38**	**34**	**31**	**43**
Min.	**26**	**6**	**1**	**22**	**5**	**0.5**
Max.	**70**	**44**	**14**	**78**	**37**	**11**
n =	**45**	**497**	**497**	**30**	**217**	**217**

Table 58. Dorsal scar patterning, blades, Howiesons Poort, D-sample, cave 1A

Dorsal scar pattern	%	n
Platform thinning flake	**2**	6
Central arris	**24**	92
Skewed arris	**12**	46
Small triangular	**17**	64
Long triangular	**1**	5
Multiple	**3**	14
Parallel	**15**	57
Multiple platform	**0**	0
Converging in middle	**7**	28
Shallow dorsal scars	**19**	71
n =	**100**	383

MSA lll

PLATFORMS

Table 59. Platform type of MSA lll blades and points, D-sample

	Blades		**Points**	
	%	n	%	n
Soft hammer:			**0**	0
Plain	**10**	14	**0**	0
Planar faceted	**0**	0	**0**	0
Convex faceted	**3**	4	**0**	0
Hard hammer:				
Plain	**41**	58	**27**	4
Planar faceted	**12**	18	**20**	3
Convex faceted	**12**	17	**40**	6
Shattered	**2**	3	**0**	0
Informal faceted	**19**	26	**13**	2
n =	**100**	140	**100**	15

Table 60. Descriptive statistics, platforms of blades and points, MSA III, D-sample

	Blades		Points	
	Plwidth	**Plthickn.**	**Plwidth**	**Plthickn.**
Mean	**20.6**	**7.9**	**28.5**	**11.1**
SD	**8.6**	**3.7**	**7.4**	**2.8**
CV	**42**	**47**	**26**	**25**
Min.	**6**	**1**	**20**	**8**
Max.	**47**	**25**	**44**	**16**
n =	**137**	**137**	**15**	**15**

Table 61. Descriptive statistics, soft-hammer platforms, MSA III, D-sample

	Plwidth	**Plthickn.**
Mean	**11.1**	**3.3**
SD	**3.3**	**1.2**
CV	**30**	**36**
Min.	**6**	**1**
Max.	**16**	**5**
n =	**18**	**18**

Table 62: Provenance of soft-hammer products in the MSA III sequence, D-sample

Layer	n
TSG	
TSC	**12**
TSB	**1**
TSA	
TSAS	
TSAT	
CP1	
AT	**1**
AU	
AV	
AB	**2**
BSL	**2**
CP2	**3**
BSS1	**1**
BSS2	**1**
CP3	**3**
BSS3	
CP4	**2**
BSS5	
BS	
YS1	
YS2	
Total	**28**

Table 63. Platform angles, blades and points, MSA III, D-sample

	%	n
81-90	**66**	102
71-80	**25**	38
61-70	**5**	8
51-60	**3**	4
41-50	**1**	1
31-40	**0**	0
21-30	**0**	0
11-20	**0**	0
0-9	**0**	0
n =	**100**	153

BLANK DESCRIPTION

Table 64. Descriptive statistics, blades, MSA lll, D-sample

	Blades			Points		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**77.8**	**25.7**	**7.7**	**64.2**	**34.0**	**10.2**
SD	**31.4**	**9.0**	**4.1**	**18.4**	**7.2**	**2.3**
CV	**40**	**35**	**53**	**29**	**21**	**22**
Min.	**38**	**7**	**2**	**41**	**23**	**7**
Max.	**145**	**58**	**41**	**99**	**44**	**14**
n =	**23**	**259**	**259**	**11**	**15**	**15**

Table 65. Dorsal scar patterning, points and blades, MSA lll, D-sample

Dorsal scar pattern	Blades		Points	
	%	n	%	n
Platform thinning flake	**3**	4	**0**	0
Central arris	**29**	34	**32**	5
Skewed arris	**15**	18	**20**	3
Small triangular	**7**	8	**33**	5
Long triangular	**0**	0	**0**	0
Multiple scars	**21**	24	**13**	2
Parallel	**0**	0	**0**	0
Multiple platform	**12**	14	**0**	0
Converging in middle	**13**	15	**0**	0
n =	**100**	117	**100**	15

Correlations

Table 66. Correlation, platform thickness and piece length, D-sample

	Blades	Large blades	Points
Upper MSA 11	**0.5**	**0.2**	**0.3**
Lower MSA 11	**0.5**	**0.1**	**0.3**
MSA 1	**-0.07**	**-**	**0.08**

Table 67. Correlation, platform thickness and piece thickness, D-sample

	Blades	Large blades	Points
Upper MSA 11	**0.6**	**0.7**	**0.8**
Lower MSA 11	**0.7**	**0.5**	**0.6**
MSA 1	**0.5**	**0.6**	**0.6**

Table 68. Correlation, platform width and piece width, D-sample

	Blades	Large blades	Points
Upper MSA 11	**0.7**	**0.7**	**0.7**
Lower MSA 11	**0.7**	**0.5**	**0.7**
MSA 1	**0.5**	**0.3**	**0.4**

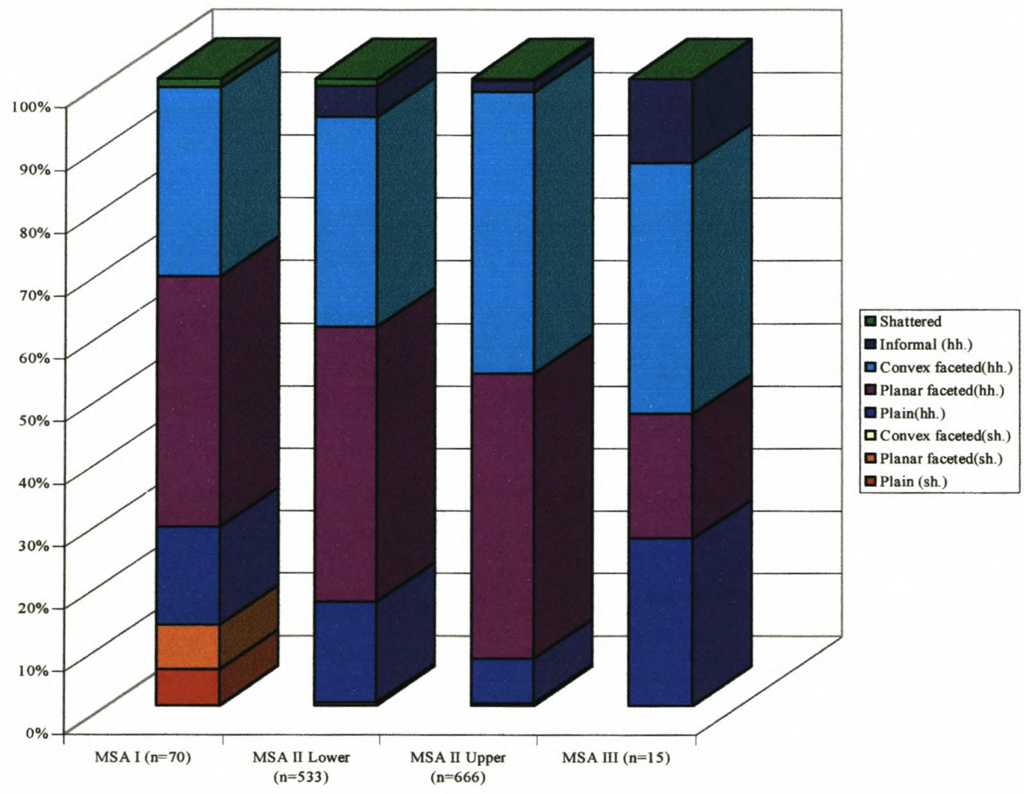


Figure 43. Platform types, points.

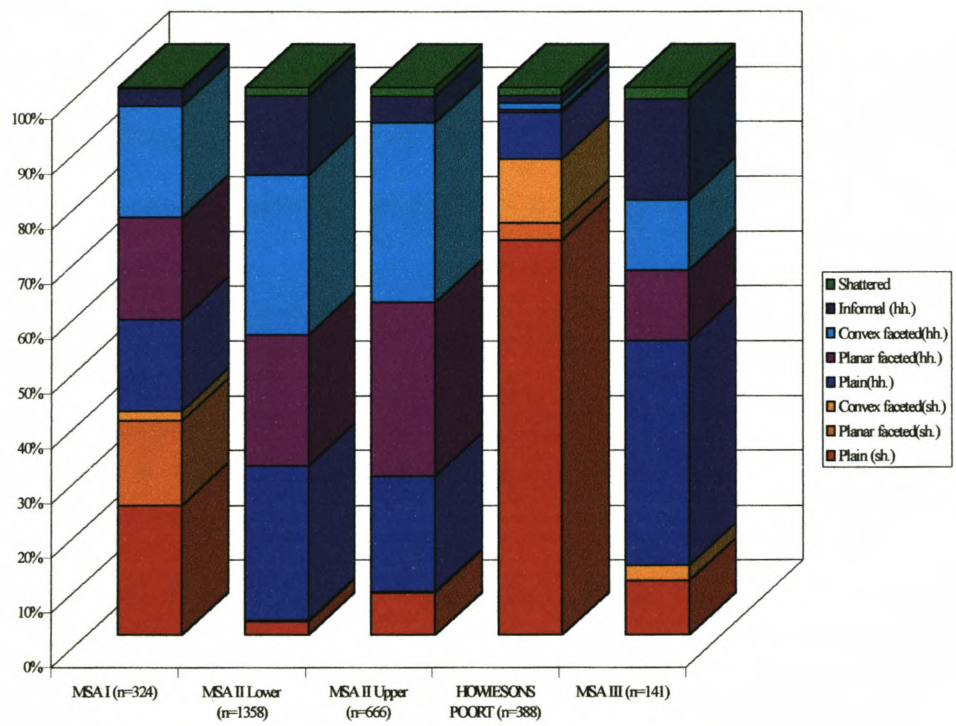


Figure 44. Platform types, blades.

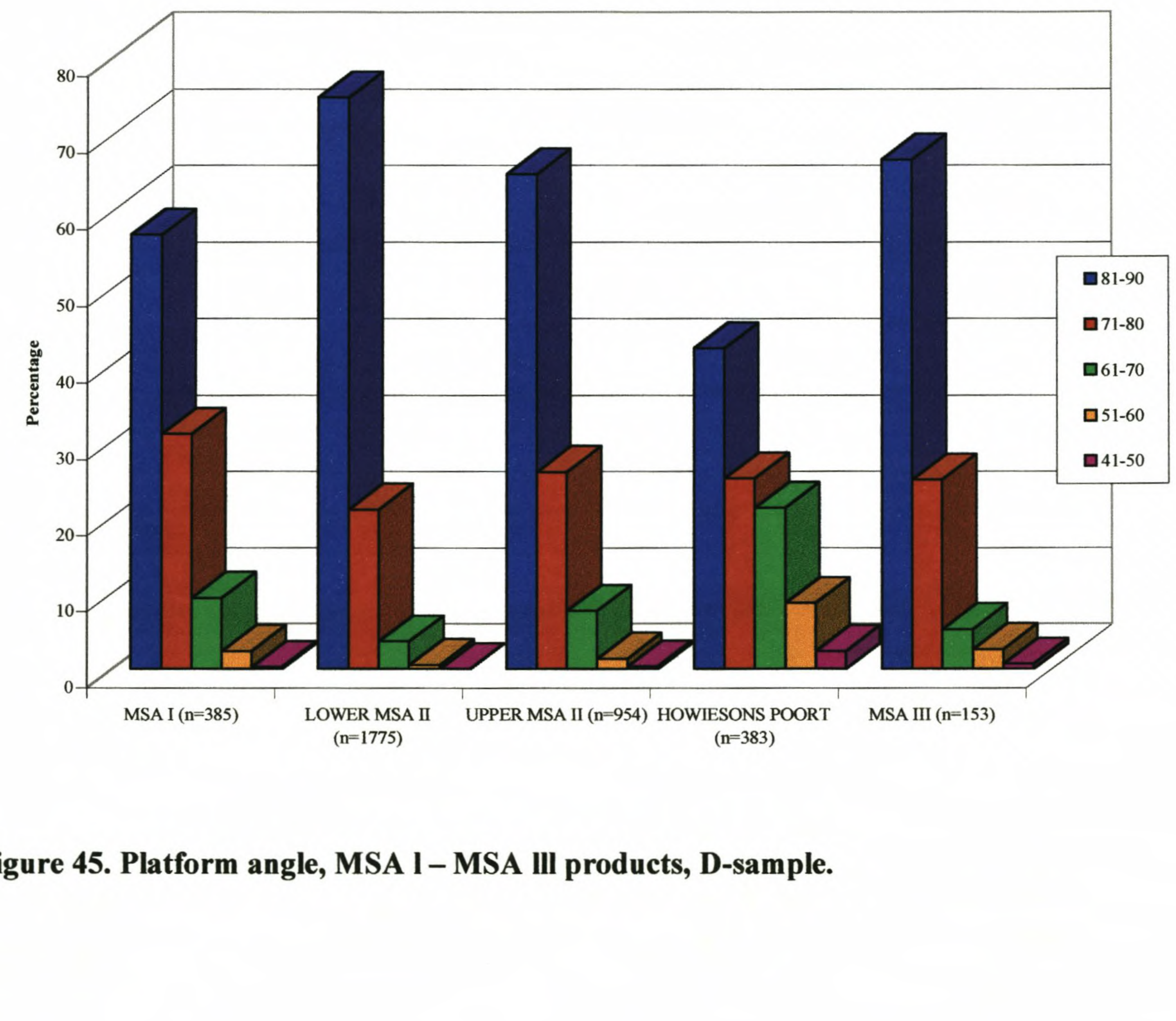


Figure 45. Platform angle, MSA I – MSA III products, D-sample.

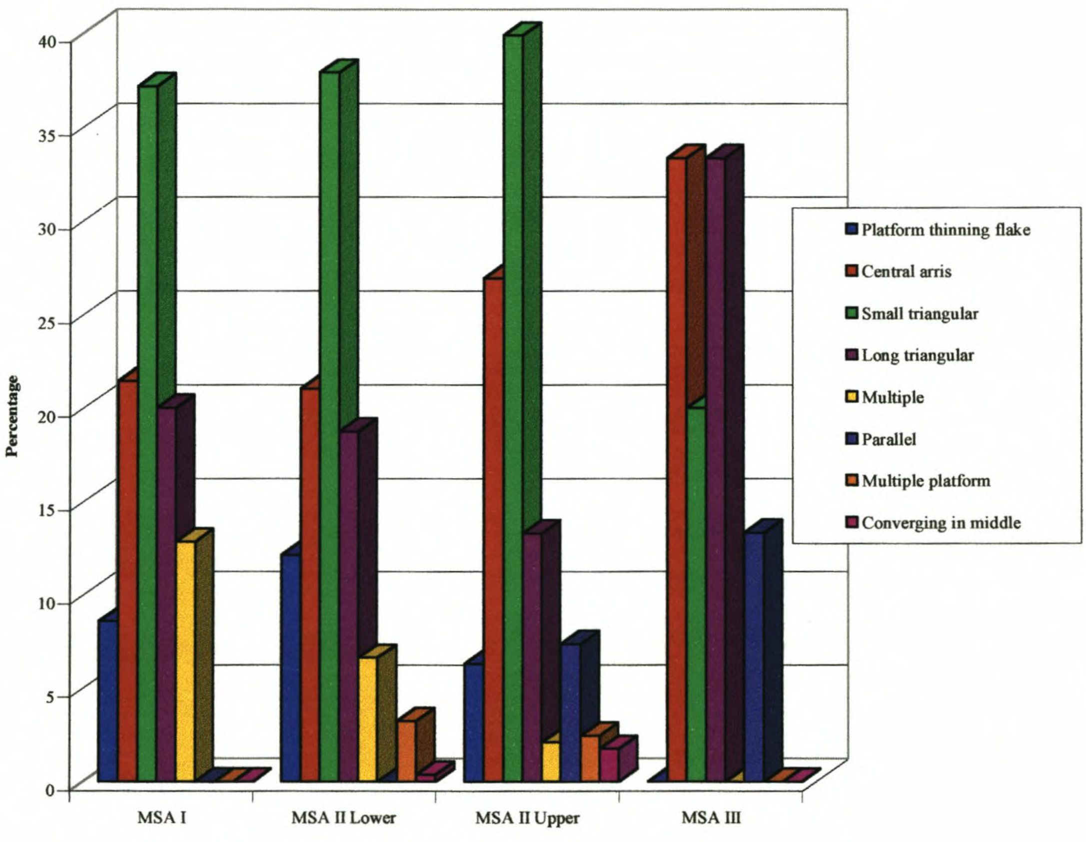


Figure 46. Dorsal scars, points, D-sample.

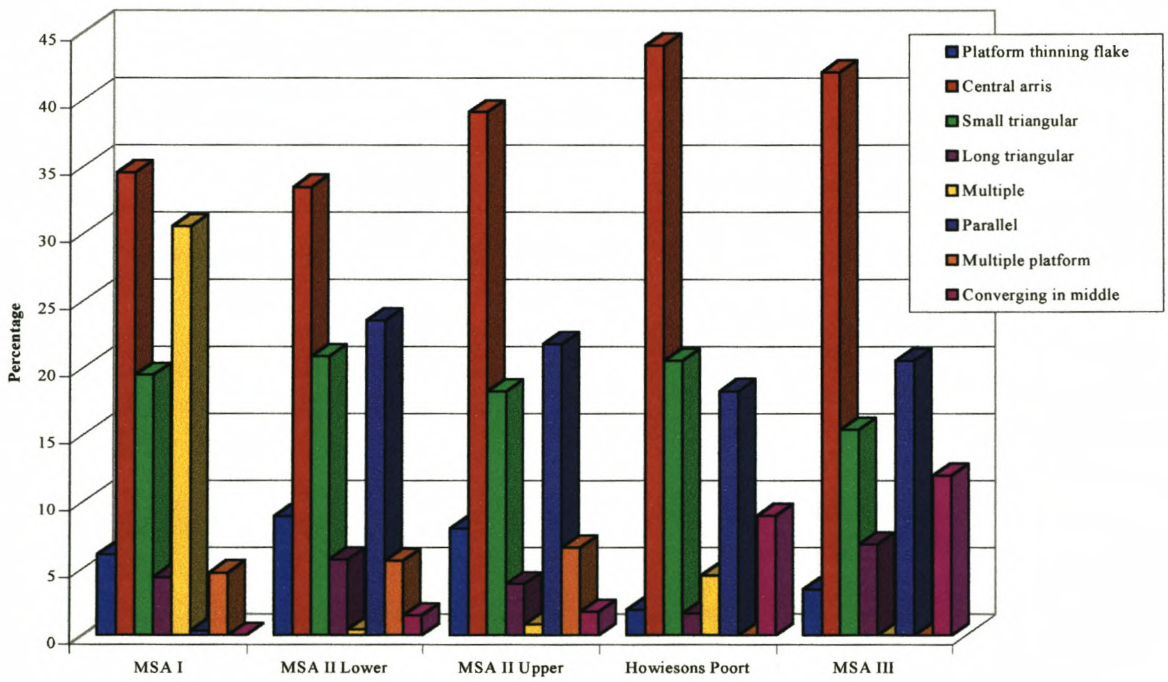


Figure 47. Dorsal scars, blades, D-sample.

Trends through time for length, width and thickness of points and blades

LENGTH, WIDTH AND THICKNESS OF POINTS AND BLADES, D-SAMPLE (SASU & SASW SUB-MEMBERS)

Table 69. Length of blades and points, upper MSA II (SAS sub-member)

	Blades				Points			
Grouped Layers	**L51**	**J48/K48**	**M50 YS1-O50 SL6CP**	**O50 BS2-T50 BS4L**	**L51**	**J48/K48**	**M50 YS1-O50 SL6CP**	**O50 BS2-T50 BS4L**
Mean	**50.5**	**59.3**	**58.5**	**63.0**	**51.5**	**52.1**	**55.4**	**60.2**
SD	**3.8**	**13.2**	**15.4**	**18.8**	**18.4**	**9.6**	**16.8**	**17.7**
CV	**7**	**22**	**26**	**30**	**36**	**18**	**30**	**29**
Min.	**48**	**39**	**34**	**38**	**35**	**40**	**22**	**37**
Max.	**56**	**78**	**94**	**110**	**72**	**70**	**98**	**130**
n=	**4**	**10**	**27**	**58**	**4**	**8**	**32**	**44**

Table 70. Length of blades, upper MSA II (SASW sub-member)

Grouped layers	B1-3	J1-3	J4	J5	J6	H1	H2	H3
Mean	**53.4**	**52.4**	**81.4**	**74.0**	**80.1**	**73.7**	**77.4**	**75.6**
SD	**16.8**	**18.8**	**27.0**	**20.2**	**28.7**	**25.2**	**21.8**	**25.1**
CV	**32**	**36**	**33**	**27**	**36**	**34**	**28**	**33**
Min.	**28**	**23**	**50**	**38**	**49**	**36**	**20**	**20**
Max.	**97**	**96**	**117**	**110**	**145**	**120**	**116**	**110**
n =	**33**	**35**	**11**	**21**	**26**	**22**	**11**	**20**

Table 71. Length of points, upper MSA II (SASW sub-member)

Grouped layers	B1-3	J1-3	J4	J5	J6	H1	H2	H3
Mean	**54.8**	**50.7**	**62.4**	**60.3**	**58.6**	**63.4**	**59.1**	**58.7**
SD	**13.8**	**12.6**	**21.1**	**15.1**	**14.7**	**17.6**	**16.8**	**18.2**
CV	**25**	**25**	**33**	**25**	**25**	**27**	**28**	**31**
Min.	**38**	**29**	**33**	**34**	**31**	**46**	**45**	**36**
Max.	**89**	**82**	**110**	**82**	**112**	**105**	**77**	**89**
n =	**12**	**22**	**14**	**18**	**35**	**19**	**19**	**20**

Table 72. Length of blades, lower MSA II (SASU sub-member)

Grouped layers	D1	D2	FMT	FMS	FMB	FMB2	SSM	SMB	SMB2	TSM	OHO	HHH
Mean	**71.0**	**71.3**	**76.5**	**79.3**	**61.5**	**87.7**	**73.4**	**78.5**	**80.4**	**73.1**	**76.7**	**73.3**
SD	**21.5**	**24.0**	**28.4**	**25.1**	**25.9**	**28.6**	**26.0**	**20.2**	**29.8**	**25.3**	**24.7**	**29.7**
CV	**30**	**34**	**37**	**32**	**42**	**33**	**36**	**26**	**37**	**35**	**32**	**41**
Min.	**36**	**41**	**57**	**53**	**36**	**57**	**42**	**46**	**46**	**42**	**38**	**48**
Max.	**112**	**126**	**145**	**145**	**120**	**140**	**125**	**120**	**140**	**134**	**127**	**156**
n =	**21**	**58**	**24**	**26**	**36**	**6**	**8**	**17**	**9**	**21**	**42**	**15**

Table 73. Length of points, lower MSA II (SASU sub-member)

Grouped layers	D1	D2	FMT	FMS	FMB	FMB2	SSM	SMB	SMB2	TSM	OHO	HHH
Mean	**59.3**	**62.2**	**72.5**	**68.7**	**51.8**	**60.8**	**65.9**	**69.4**	**76.4**	**63.7**	**61.8**	**66.5**
SD	**12.4**	**11.3**	**20.3**	**22.3**	**20.1**	**10.0**	**19.6**	**21.8**	**6.9**	**11.3**	**20.8**	**22.6**
CV	**20**	**18**	**28**	**32**	**34**	**16**	**29**	**28**	**9**	**17**	**30**	**30**
Min.	**38**	**39**	**47**	**45**	**36**	**43**	**42**	**45**	**69**	**46**	**45**	**43**
Max.	**79**	**98**	**118**	**130**	**87**	**73**	**100**	**92**	**86**	**93**	**104**	**94**
n =	**26**	**55**	**18**	**17**	**17**	**10**	**8**	**17**	**8**	**15**	**23**	**17**

WIDTH

Table 74. Width of blades and points, upper MSA II (SAS sub-member)

	Blades				Points			
Grouped layers	L51	J48/K48	M50 YS1-O50 SL6CP	O50 BS2-T50 BS4L	L51	J48/K48	M50 YS1-O50 SL6CP	O50 BS2-T50 BS4L
Mean	21.5	24.5	28.4	26.8	27.2	33.5	33.1	33.6
SD	4.5	6.1	8.9	8.8	9.6	7.3	7.2	7.2
CV	21	25	31	33	35	22	22	21
Min.	9	6	11	7	11	23	22	20
Max.	31	43	80	63	39	50	50	55
n=	42	49	101	502	6	12	37	59

Table 75. Width of blades, upper MSA II (SASW sub-member)

Grouped layers	B1-3	J1-3	J4	J5	J6	H1	H2	H3
Mean	26.9	23.2	30.3	26.4	29.2	28.7	28.6	28.0
SD	7.8	7.8	11.3	12.0	8.7	8.8	8.9	10.4
CV	29	33	37	45	29	30	31	37
Min.	16	11	14	6	16	8	14	7
Max.	45	41	49	58	57	48	46	58
n =	49	63	16	41	68	65	30	59

Table 76. Width of points, upper MSA II (SASW sub-member)

Grouped layers	B1-3	J1-3	J4	J5	J6	H1	H2	H3
Mean	31.6	27.6	30.9	29.6	30.1	31.0	30.0	33.0
SD	12.6	8.1	7.4	8.0	4.8	8.6	7.9	7.6
CV	39	29	24	27	16	27	26	23
Min.	18	16	17	19	22	22	25	21
Max.	64	49	45	44	43	43	41	51
n =	13	27	16	20	47	22	20	20

Table 77. Width of blades, lower MSA II (SASU sub-member)

Grouped layers	D1	D2	FMT	FMS	FMB	FMB2	SSM	SMB	SMB2	TSM	OHO	HHH
Mean	28.7	32.8	32.5	34.0	32.8	30.4	32.4	33.2	36.1	35.[illegible]	34.7	35.2
SD	8.3	11.4	11.1	10.2	8.6	8.4	9.9	8.8	8.7	8.[illegible]	8.9	8.0
CV	29	34	34	30	26	27	30	26	24	24	25	22
Min.	13	14	17	18	19	16	18	18	22	18	17	23
Max.	55	72	67	66	54	46	62	55	49	55	63	62
n =	57	183	85	77	105	34	36	45	20	55	145	46

Table 78. Width of points, lower MSA II (SASU sub-member)

Grouped layers	D1	D2	FMT	FMS	FMB	FMB2	SSM	SMB	SMB2	TSM	OHO	HHH
Mean	30.6	33.3	39.0	32.7	34.0	30.3	30.2	35.5	43.3	41.[illegible]	36.5	36.2
SD	6.4	7.2	8.6	6.1	9.5	9.4	5.2	8.7	6.9	7.[illegible]	9.1	6.5
CV	21	21	22	18	28	31	17	24	16	17	25	18
Min.	20	21	24	22	10	20	20	19	30	31	20	21
Max.	50	59	61	53	49	53	40	55	52	52	55	49
n =	27	70	25	27	31	13	12	21	9	21	35	26

THICKNESS

Table 79. Thickness of blades and points, upper MSA II (SAS sub-member)

	Blades				Points			
Grouped layers	L51	J48/K48	M50 YS1-O50 SL6CP	O50 BS2-T50 BS4L	L51	J48/K48	M50 YS1-O50 SL6CP	O50 BS2-T50 BS4L
Mean	6.48	7.61	9.51	8.32	10.00	11.33	11.76	10.69
SD	2.58	2.14	3.41	3.38	2.00	3.34	2.99	2.22
CV	40	28	36	41	20	29	25	21
Min.	2	3	4	2	8	7	5	6
Max.	16	12	20	21	13	18	20	16
n=	42	49	101	502	5	12	37	59

Table 80. Thickness of blades, upper MSA II (SASW sub-member)

Grouped layers	B1-3	J1-3	J4	J5	J6	H1	H2	H3
Mean	8.4	8.2	11.6	10.4	10.2	9.9	9.7	9.1
SD	3.1	2.8	5.7	4.2	3.3	4.4	3.5	3.1
CV	36	34	49	40	32	44	36	34
Min.	3	2	3	4	5	4	4	4
Max.	15	16	25	18	20	30	17	18
n =	49	63	16	41	68	66	29	57

Table 81. Thickness of points, upper MSA II (SASW sub-member)

	B1-3	J1-3	J4	J5	J6	H1	H2	H3
Mean	9.1	9.3	9.9	9.3	9.7	10.1	9.8	11.2
SD	3.8	3.2	3.6	3.1	2.4	2.5	1.9	3.4
CV	41	34	37	33	24	24	19	30
Min.	4	4	6	4	4	4	6	5
Max.	16	17	20	15	15	15	13	16
n =	13	27	16	20	47	22	20	20

Table 82. Thickness of blades, lower MSA II (SASU sub-member)

	D1	D2	FMT	FMS	FMB	FMB2	SSM	SMB	SMB2	TSM	OHO	HHH
Mean	9.2	10.6	10.4	10.8	10.4	8.5	9.8	10.4	10.9	11.3	11.1	11.0
SD	3.6	3.7	5.0	4.8	3.3	3.3	3.5	3.3	4.0	4.4	3.6	3.2
CV	38	34	48	44	32	39	35	31	36	38	32	28
Min.	3	4	4	5	5	4	5	5	6	5	5	5
Max.	20	25	42	29	21	18	20	17	20	33	23	20
n =	56	182	85	75	105	34	36	45	20	55	145	46

Table 83. Thickness of points, lower MSA II (SASU sub-member)

	D1	D2	FMT	FMS	FMB	FMB2	SSM	SMB	SMB2	TSM	OHO	HHH
Mean	**9.5**	**10.4**	**12.3**	**10.4**	**10.9**	**9.0**	**10.5**	**11.5**	**11.9**	**12.3**	**11.1**	**10.9**
SD	**2.2**	**2.4**	**4.2**	**2.1**	**3.7**	**3.4**	**3.4**	**3.0**	**3.2**	**2.8**	**3.6**	**2.7**
CV	**23**	**22**	**33**	**20**	**33**	**37**	**32**	**26**	**26**	**22**	**32**	**24**
Min.	**6**	**6**	**7**	**6**	**5**	**5**	**6**	**7**	**8**	**5**	**5**	**4**
Max.	**15**	**17**	**22**	**15**	**20**	**15**	**19**	**18**	**16**	**15**	**21**	**17**
n =	**27**	**70**	**25**	**27**	**30**	**13**	**12**	**21**	**9**	**21**	**35**	**26**

Length, width and thickness ratios of blades and points, D-sample

Table 84. Length, width and thickness ratios of blades, D-sample

Mean ratios (x100)	20 n=120 (30)	19 n=172 (170)	18 n=80 (11)	17 n=272 (74)	16 n=325 (82)	15 n=298 (55)	14 n=345 (69)	13 n=411 (52)	12 n=252 (64)	11 n=166 (66)	10 n=50 (7)	9 n=47 (10)	8 n=43 (4)	7 n=79 (4)	6 n=299 (20)	5 n=114 (13)	4 n=123 (23)	3 n=99 (15)	2 n=212 (23)	1 n=49
Length/thickn.	**9.0**	**9.1**	**9.3**	**7.9**	**8.1**	**7.6**	**7.2**	**7.1**	**7.4**	**6.4**	**5.8**	**6.8**	**6.8**	**7.9**	**7.3**	**8.9**	**7.5**	**9.5**	**7.9**	
Length/width	**2.8**	**2.6**	**2.8**	**2.3**	**2.5**	**2.4**	**2.4**	**2.6**	**2.6**	**2.4**	**1.9**	**2.2**	**2.9**	**2.3**	**2.1**	**2.6**	**2.2**	**2.4**	**2.4**	
Width/thickn.	**3.7**	**3.8**	**3.9**	**3.4**	**3.4**	**3.4**	**3.4**	**3.3**	**3.2**	**3.1**	**3.1**	**3.5**	**3.6**	**4.6**	**4.1**	**4.8**	**4.2**	**4.1**	**3.7**	**3.6**

Length totals in brackets.

Layer numbers as in Table 16, Appendix 2.

Table 85. Length, width and thickness ratios of points, D-sample

Mean ratios (x100)	20 n=17 (6)	19 n=14 (12)	18 n=11 (10)	17 n=87 (65)	16 n=98 (79)	15 n=100 (68)	14 n=112 (91)	13 n=93 (80)	12 n=101 (84)	11 n=44 (37)	10 n=28 (24)	9 n=11 (7)	8 n=7 (4)	2 n=15 (11)
Length/thickn.	**8.7**	**8.9**	**8.8**	**7.0**	**6.5**	**6.0**	**6.3**	**6.1**	**6.1**	**5.9**	**5.1**	**4.8**	**5.1**	**8.9**
Width/thickn.	**4.0**	**4.5**	**3.5**	**3.5**	**3.4**	**3.4**	**3.3**	**3.2**	**3.2**	**3.2**	**2.9**	**3.2**	**2.9**	**3.4**
Length/width	**2.2**	**2.0**	**2.3**	**2.0**	**2.0**	**1.9**	**2.0**	**1.9**	**2.0**	**1.9**	**1.8**	**1.6**	**1.9**	**1.5**

Length totals in brackets.

Layer numbers as in Table 16, Appendix 2.

Retouch

EDGE DAMAGE, NOTCHES AND DENTICULATES

Table 86. Damage on blades and points from the MSA I – MSA III, D-sample

	MSA 1		Lower MSA II		Upper MSA II		HP		MSA III	
	%	n	%	n	%	n	%	n	%	n
None	**87.3**	474	**65.1**	1521	**61.8**	848	**95.5**	2227	**91.9**	679
Lateral	**6.8**	37	**18.2**	425	**27.0**	370	**1.2**	27	**5.1**	38
Notched	**5.0**	27	**13.3**	311	**7.9**	108	**0.5**	11	**0.9**	7
Denticulate	**0.9**	5	**2.4**	57	**2.4**	33	**0.2**	5	**0.9**	7
Retouched	**0**	0	**0.9**	22	**0.9**	13	**2.6**	61	**1.1**	8
n =	**100**	543	**100**	2336	**100**	1372	**100**	2331	**100.0**	739

Table 87. Damage on blades versus points, MSA I – MSA II, D-sample

	MSA 1				Lower MSA 11				Upper MSA 11			
	Blades		**Points**		**Blades**		**Points**		**Blades**		**Points**	
	%	n	%	n	%	n	%	n	%	n	%	n
None	**89.0**	420	**76.1**	54	**69.6**	1246	**50.5**	275	**66.6**	715	**44.6**	133
Lateral damage	**6.6**	31	**8.5**	6	**15.9**	285	**25.7**	140	**22.9**	246	**41.6**	124
Notched	**3.8**	18	**12.7**	9	**11.7**	210	**18.5**	101	**7.4**	80	**9.4**	28
Denticulate	**0.6**	3	**2.8**	2	**2.3**	42	**2.8**	15	**2.5**	27	**2.0**	6
Retouched	**0**	0	**0.0**	0	**0.4**	8	**2.6**	14	**0.6**	6	**2.3**	7
n =	**100**	472	**100**	71	**100**	1791	**100**	545	**100**	1074	**100**	298

Table 88. Descriptive statistics, Howiesons Poort notch classes, SW-sample

	Break-out	Complex	Woodwork
Mean width of notch (mm)	**7.4**	**9**	**15.1**
SD	**3.2**	**3,8**	**6.1**
CV	**43**	**41**	**40**
Minimum width	**3**	**3**	**3**
Maximum width	**19**	**22**	**37**
n= (% in brackets)	**132 (57%)**	**34 (13%)**	**71 (30%)**

Table 89. Frequencies of notches per notched piece, SW-sample

No. of notches per piece	%	n
1	**53**	71
2	**25**	32
3	**11**	14
4	**8**	10
5	**1**	1
6	**2**	3
n=	**100**	131

Table 90. Comparison of denticulate and notched piece length, width and thickness, SW-sample

	Length		Width		Thickness	
	Notched	Denticulate	Notched	Denticulate	Notched	Denticulate
Mean	**41.2**	**49**	**18.8**	**18.2**	**5.6**	**6.2**
SD	**12.6**	**9.1**	**7.2**	**5.7**	**3.2**	**2.0**
CV	**30**	**18**	**38**	**31**	**56**	**33**
Min.	**20**	**39**	**3**	**8**	**2**	**3**
Max.	**70**	**57**	**51**	**36**	**20**	**13**
n =	**22**	**3**	**101**	**30**	**101**	**30**

BACKED ARTEFACTS

Table 91. Descriptive statistics, length, width and thickness of backed artefacts, SW-sample

	All materials			Quartzite			Non-quartzite		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**36.6**	**15.9**	**4.6**	**38.2**	**16.7**	**4.8**	**34.6**	**14.9**	**4.3**
SD.	**9.4**	**3.4**	**1.2**	**9.8**	**3.4**	**1.1**	**8.7**	**3.3**	**1.2**
CV	**25.8**	**21.7**	**26.4**	**26**	**20**	**23**	**25**	**22**	**29**
Min.	**9**	**5**	**2**	**17**	**7**	**2**	**9**	**5**	**2**
Max.	**72**	**29**	**9**	**72**	**29**	**9**	**58**	**27**	**9**
n =	**630**	**828**	**828**	**341**	**442**	**442**	**288**	**386**	**386**

Table 92. Descriptive statistics, length, width and thickness of backed artefacts, D-sample, cave 2

	All materials			Quartzite			Non-quartzite		
	Length	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**	**Length**	**Width**	**Thickn.**
Mean	**36.6**	**13.74**	**4.3**	**38.7**	**14.0**	**4.4**	**34.8**	**13.0**	**4.3**
SD.	**10.5**	**3.6**	**1.2**	**10.1**	**43.8**	**1.4**	**10.9**	**3.4**	**1.1**
CV	**29**	**27**	**30**	**26**	**27**	**32**	**31**	**26**	**26**
Min.	**21**	**8**	**2**	**22**	**10**	**2**	**21**	**8**	**2**
Max.	**70**	**24**	**8**	**62**	**24**	**8**	**70**	**22**	**6**
n=	**58**	**74**	**74**	**31**	**44**	**44**	**27**	**30**	**30**

Table 93. Descriptive statistics, length, width and height, backed artefacts of D-sample, cave 1A

	All materials			Quartzite			Non-quartzite		
	Length	**Width**	**Thickn**	**Length**	**Width**	**Thickn**	**Length**	**Width**	**Thickn**
Mean	**35.1**	**15.3**	**4.6**	**37.6**	**15.7**	**4.8**	**27.6**	**14.1**	**4.1**
SD	**9.7**	**2.7**	**1.1**	**9.2**	**2.6**	**1.0**	**7.4**	**2.8**	**1.3**
CV	**28**	**18**	**25**	**25**	**17**	**22**	**27**	**20**	**32**
Min	**16**	**9**	**2**	**25**	**11**	**3**	**16**	**9**	**2**
Max.	**62**	**19**	**7**	**62**	**19**	**7**	**40**	**18**	**6**
n =	**28**	**28**	**28**	**21**	**21**	**21**	**7**	**7**	**7**

Table 94. Length through time, backed artefacts, SW-sample

Layer	21	20	19	18	17	16	15	14	13	12	11	10
Mean	**38**	**34.3**	**44.5**	**41.6**	**40.3**	**36.2**	**38**	**32.2**	**30.1**	**31.9**	**33.1**	**36.4**
SD	**4.1**	**80**	**9.2**	**8.6**	**9.6**	**9.9**	**12.2**	**6.4**	**6.5**	**6.2**	**8.7**	**7.6**
CV	**11**	**23**	**21**	**21**	**24**	**27**	**32**	**20**	**22**	**19**	**26**	**21**
Min.	**31**	**16**	**19**	**22**	**21**	**16**	**20**	**26**	**9**	**18**	**14**	**17**
Max.	**45**	**57**	**72**	**60**	**67**	**53**	**62**	**51**	**46**	**45**	**66**	**52**
n =	**12**	**130**	**71**	**40**	**74**	**33**	**14**	**14**	**26**	**61**	**90**	**54**

Table 95. Extent of backing on backed artefacts, Howiesons Poort, SW-sample

	%	n
Fully	**52**	397
Sides, not middle	**25**	193
One side	**18**	137
One side & middle	**5**	36
	100	763

Table 96. Frequencies of segments, intermediates and trapezes, Howiesons Poort, SW-sample

Shape	%	n
Segment	**60**	456
Intermediate	**29**	220
Trapeze	**11**	84
n =	**100**	760

Table 97. Change in backed artefact shape through time, SW-sample

Layer	21	20	19	18	17	16	15	14	13	12	11	10
Segment %	**57**	**65**	**67**	**70**	**37**	**17**	**58**	**81**	**65**	**69**	**64**	**74**
Intermediate%	**38**	**23**	**25**	**17**	**43**	**59**	**33**	**19**	**32**	**26**	**26**	**19**
Trapeze%	**5**	**12**	**9**	**13**	**19**	**24**	**10**	**0**	**3**	**4**	**10**	**6**
n =	**21**	**163**	**93**	**47**	**83**	**46**	**40**	**21**	**31**	**72**	**101**	**62**

Table 98. Edge-modification, Howiesons Poort backed artefacts, SW-sample

Modification	%	n
None	**34**	**278**
Light	**22**	**181**
Heavy	**27**	**223**
Single notch	**4**	**32**
Multiple notch	**1**	**6**
Single notch & use	**7**	**61**
Multiple notch & use	**5**	**45**
n =	**100**	**826**

Table 99. Index of selection of blanks preferred for the production of backed artefacts, SW-sample and D-sample (cave 1A)

Length class (mm)	% Backed artefacts (n=828) SW-sample	% Blades (n=75) D-sample (cave 1A)	Index of selection'
16-20	**3.6**	**2.9**	**1.2**
20-25	**10.7**	**9.6**	**1.1**
26-30	**25.0**	**11.5**	**2.2**
31-35	**21.4**	**15.4**	**1.4**
36-40	**14.3**	**16.3**	**0.9**
41-45	**10.7**	**20.2**	**0.5**
46-50	**7.1**	**5.8**	**1.2**
51-55	**3.6**	**6.7**	**0.5**
56-60	**0.0**	**5.8**	**0.0**
61-65	**3.6**	**3.8**	**0.9**
66-70	**0.0**	**0.0**	**0.0**
71-70	**0.0**	**0.0**	**0.0**
71-75	**0.0**	**1.9**	**0.0**

BURINS

Table 100. Descriptive statistics, length, width and thickness of technical burins, Howiesons Poort, SW-sample

	Length	Width	Thickn.
Mean	**34.1**	**20.5**	**7.1**
SD	**6.1**	**7.6**	**3.1**
CV	**17**	**36**	**44**
Min.	**25**	**7**	**4**
Max.	**44**	**33**	**12**
n =	**8**	**8**	**8**

SCRAPERS

Table 101. Descriptive statistics, scraper attributes, Howiesons Poort, SW-sample and D-sample (cave 1A)

	SW-sample				D-sample, cave 1A			
	Length	Width of piece	Thickn.	Width of retouch	Length	Width of piece	Thickn.	Width of retouch
Mean	**40.7**	**26.7**	**7.1**	**24.5**	**30.5**	**27.5**	**11.5**	**29**
SD	**11.7**	**4.6**	**1.9**	**6.0**	**2.1**	**6.4**	**4.9**	**2.8**
CV	**28.9**	**17.1**	**27.0**	**24.6**	**7**	**23**	**43**	**10**
Min.	**20**	**16**	**4**	**14**	**29**	**23**	**8**	**27**
Max.	**60**	**35**	**10**	**35**	**32**	**32**	**15**	**31**
n =	**15**	**15**	**15**	**15**	**2**	**2**	**2**	**2**

OCHRE

Table 102. Modified ochre in the Howiesons Poort, SW-sample

Layer	$1cm^3$	$2cm^3$2	$3\ cm^3$	$4\ cm^3$	$>4cm^3$	Total utilised	Total found
10						**0**	**7**
11						**0**	**0**
12		**1**	**2**			**3**	**17**
13						**0**	**1**
14			**2**			**2**	**7**
15			**1**			**1**	**3**
16			**9**		**1**	**10**	**14**
17			**1**	**3**		**4**	**26**
18		**2**	**1**		**2**	**5**	**9**
19		**1**	**7**	**2**	**1**	**11**	**23**
20	**1**	**1**	**2**	**1**		**5**	**6**
21			**3**	**1**		**4**	**4**
n=	**1**	**5**	**28**	**7**	**4**	**45**	**167**

Table 103: Modified ochre D-sample, cave 1A

	1 cm^3	2 cm^3	3 cm^3	4 cm^3	>4cm^3	Total utilised	Total found
MSA lll (E50)	**2**	**2**				**4**	**33**
Howiesons Poort (E50, H51)	**6**	**4**	**1**			**11**	**47**
MSA ll upper (T51)	**1**	**1**		**1**		**3**	**5**
MSA 1l lower (Z44, Y45, PP38)	**1**	**1**		**1**	**1**	**4**	**5**
MSA 1 (AA43, PP38)	**1**			**1**		**2**	**2**
n=	**11**	**8**	**1**	**3**	**1**	**24**	**92**

APPENDIX 3

PAARDEBERG

In 1966 L. du Plessis, while attending a school in Joubertina, dug a series of potholes in the floor of a cave on the farm Paardeberg, near Opkomst in the Longkloof. In 1972, as part of the Longkloof Archaeological Research Project (Deacon, H.J. 1976), a metre square was excavated to establish the sequence.

The depth of the deposit is 600 mm. The upper 400 m are ashy loams with plant remains and include Later Stone Age materials, units BAD-IAD (Fig. 48). The lower series of deposits with JAD/BSL at the interface are a Middle Stone Age lag deposit. The unit KAD, radiocarbon dated to >44 000 years, is a stony grey loam and, like JAD, includes a silcrete blade industry with invasive retouched points. The basal unit overlying bedrock, MAD, is a yellow brown oxidized loam that shows an increase in Middle Stone Age artefacts made in quartzite and lacks retouched points.

The Later Stone Age materials suggest a terminal Pleistocene to Holocene age for the upper deposits. The minimum radiocarbon age-estimate for the KAD unit suggests a long hiatus between the accumulation of the upper and lower deposits. The silcrete blades from KAD have platform attributes that are typically found in the Howiesons Poort levels at Klasies River main site. Of the blades, 78% have 'soft hammer' platforms of comparable size (Table 104, 105 & 106). While the length, width, thickness and dorsal scar pattern (Tables 106 – 109) of the Paardeberg blades are similar to those in the Howiesons Poort, they are more variable. There are two (of a total of four) invasive retouched points and a scraper is illustrated (Fig. 49). On technological grounds it can be suggested that the age of the materials from JAD -KAD is of the same order of age as the Howiesons Poort. The quartzite industry in the MAD unit would be more comparable in age to the MSA ll.

The Paardeberg sample is significant because it shows a component of the Middle Stone Age sequence not, or not well represented at Klasies River main site. There are invasive retouched pieces in the top of the MSA ll and in the base of the Howiesons Poort sub-members at main site, but there is no set of units with a high frequency of such pieces that may represent the presence of a discrete 'Stillbay' horizon. The RF Member in the main site stratigraphic sequence has not been well sampled and covers a period, possibly an extended period, of ephemeral occupation. This period may be represented in the condensed sequence at Paardeberg. At Paardeberg there are few pieces with backing retouch that are similar to pieces in the Howiesons Poort (Volman 1981:243), but there are some 14 whole and fragmentary invasively flaked points. In a temporal succession the switch from producing points with invasive flaking to segments with backing can be interpreted as changing stylistic expression and associated with symbolic communication.

Table 104. Summary table: comparison, blade attributes, Howiesons Poort (cave 1A, main site) and Paardeberg

	Paardeberg	Howiesons Poort
Mean platform width	**9.0** (n=71)	**11.6** (n=383)
Mean platform thickness	**2.8**	**3.7**
Mean blade length	**34.9** (n=17)	**43.9** (n=75)
Mean blade width	**18.4** (n=251)	**18.8** (n=714)
Mean blade thickness	**4.3**	**4.9**

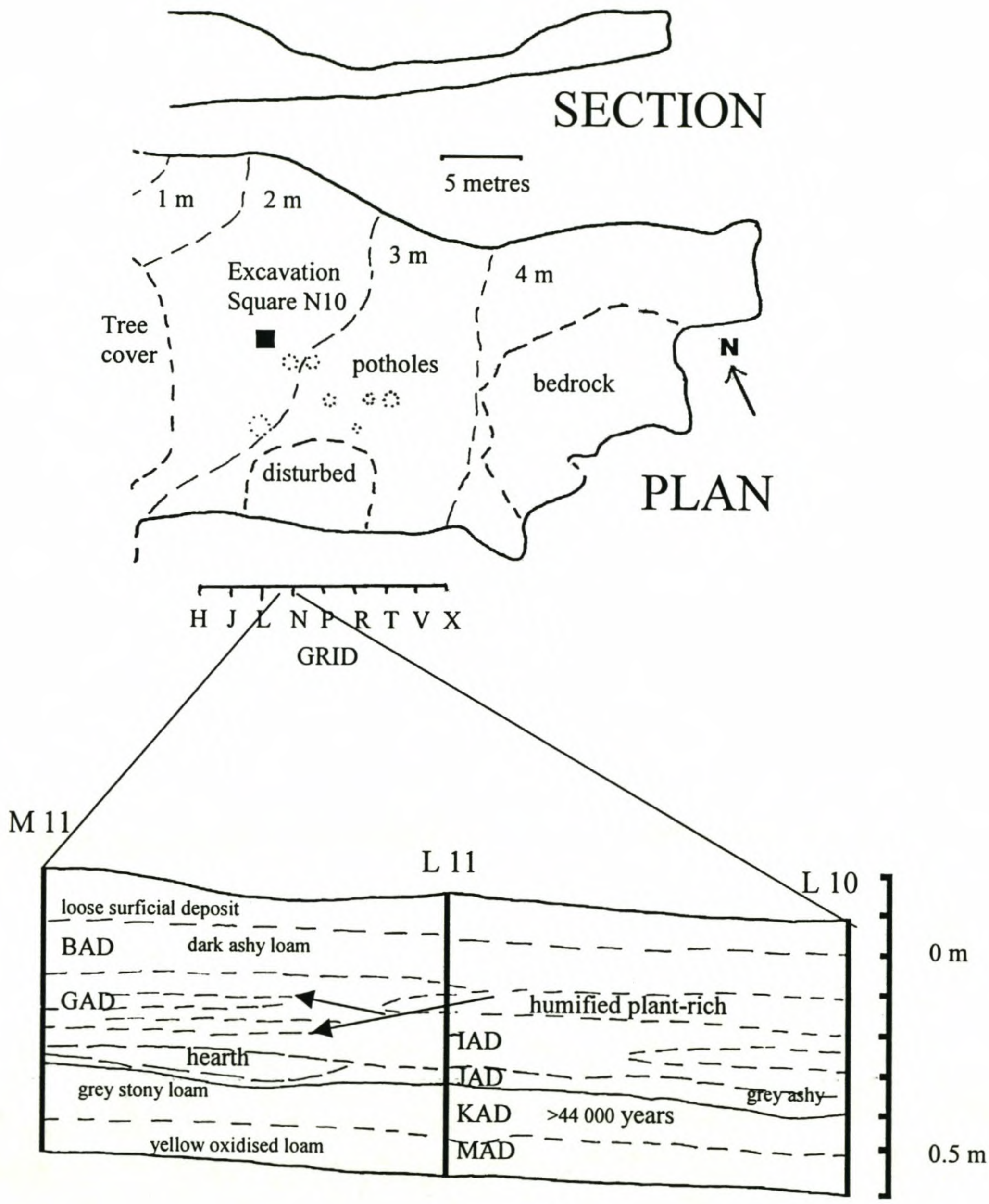


Figure 48. Plan and section of Paardeberg Cave and stratigraphy of excavation.

Table 105. Platform type, Paardeberg blades

Platform type	Blades	
	%	n
Soft hammer:		
Plain	**78**	61
Planar faceted	**0**	0
Convex faceted	**0**	0
Hard hammer:		
Plain	**5**	4
Planar faceted	**0**	0
Convex faceted	**1**	1
Shattered	**15**	11
Informal faceted	**1**	1
n =	**100**	78

Table 106. Descriptive statistics, platforms, Paardeberg blades

	Blades	
	Plwidth	**Plthickn.**
Mean	**9.0**	**2.8**
SD	**5.3**	**2.3**
CV	**58.4**	**84.3**
Min.	**1**	**1**
Max.	**27**	**10**
n =	**71**	**71**

Table 107. Descriptive statistics, Paardeberg blades

	Length	Width	Thickn.
Mean	**34.9**	**18.4**	**4.3**
SD	**12.0**	**4.5**	**1.5**
CV	**34.4**	**24.2**	**34.4**
Min.	**18**	**9**	**1**
Max.	**66**	**34**	**9**
n =	**17**	**251**	**251**

Table 108. Platform angles, Paardeberg blades

Platform angle	Blades	
	%	n
81-90	**52**	**38**
71-80	**31**	**22**
61-70	**13**	**9**
51-60	**3**	**2**
41-50	**0**	**0**
31-40	**0**	**0**
21-30	**1**	**1**
11-20	**0**	**0**
0-9	**0**	**0**
n =	**100**	**72**

Table 109. Dorsal scar patterning, Paardeberberg blades

Dorsal scar pattern	%	n
Platform thinning flake	**0**	0
Central arris	**15**	11
Small triangular	**4**	3
Long triangular	**3**	2
Multiple scars	**7**	5
Parallel	**0**	0
Multiple platform	**30**	21
Converging in middle	**41**	29
n =	**100**	71

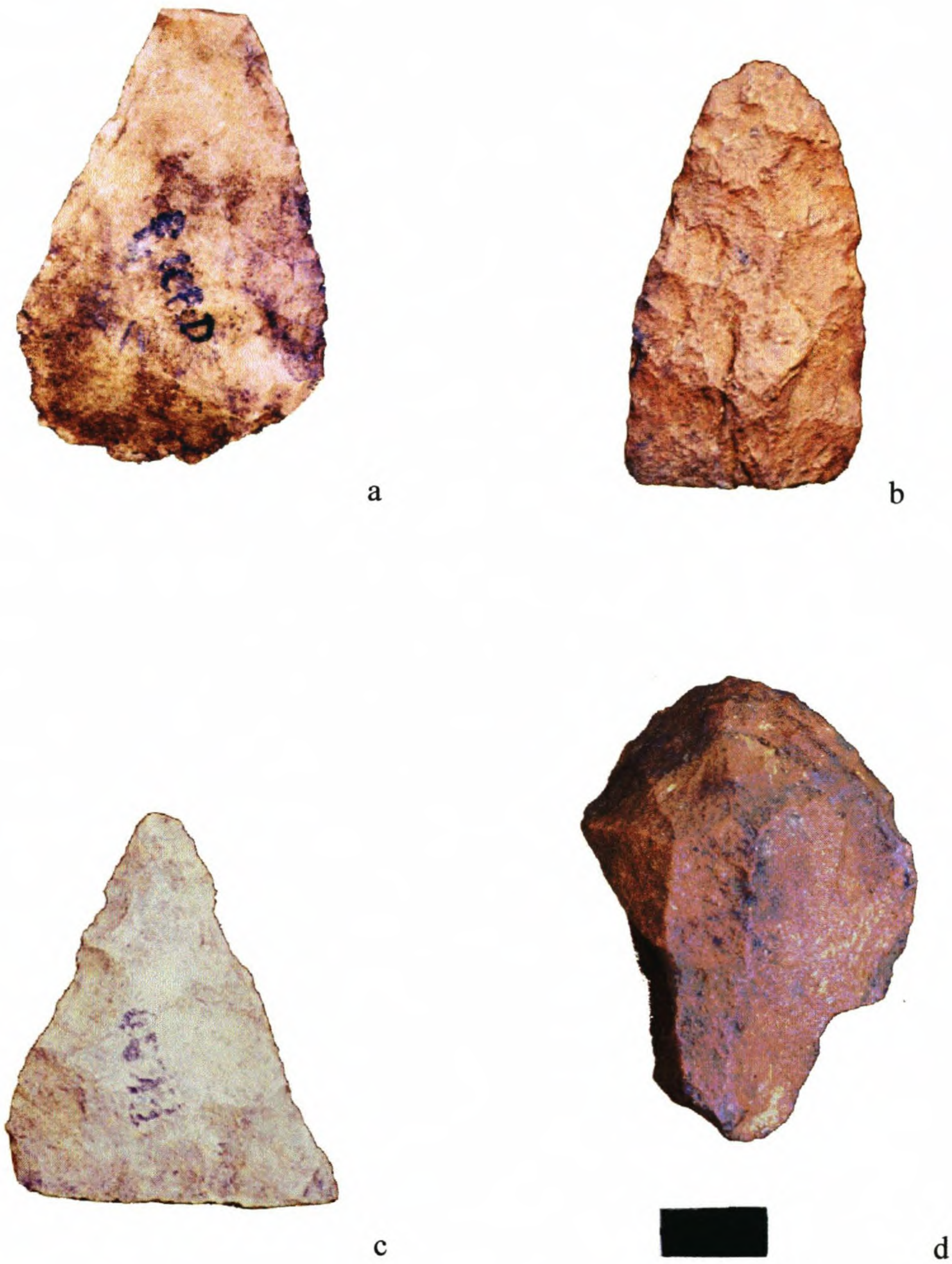


Figure 49. Invasive retouched points (a-c) and a high backed scraper (d) from the KAD unit, Paardeberg Cave (a & c, width 30 mm; b, width 20 mm).

APPENDIX 4

PUBLISHED PAPER

Wurz, S. 1999. The Howiesons Poort backed artefacts from Klasies River: an argument for symbolic behaviour. South African Archaeological Bulletin 169:38-50.

South African Archaeological Bulletin **54**: 38-50, 1999

THE HOWIESONS POORT BACKED ARTEFACTS FROM KLASIES RIVER: AN ARGUMENT FOR SYMBOLIC BEHAVIOUR*

SARAH WURZ

Department of Archaeology
University of Stellenbosch
PO Box X1, Matieland 7602
South Africa

email: sjdw@akad.sun.ac.za

Abstract

A chaîne opératoire *approach to the analysis of the Howiesons Poort backed artefacts from Klasies River main site was used to describe raw material acquisition, blank production and selection, modification through retouch and use. The results show that the process of making backed artefacts reflects the imposition of attributes of style. Style is equated with communication through the medium of symbols. The ability to manipulate symbols is termed symbolic behaviour and is characteristic of the sapient mind. It implies the use of language. On this evidence, the emergence of symbolic behaviour long preceded the Upper Palaeolithic.*

*Received September 1998, revised March 1999

Introduction

Howiesons Poort was the name adopted by Goodwin and van Riet Lowe (1929) for one of the variations they distinguished in the Middle Stone Age in South Africa. Noteworthy in this variation was the presence of tool types that were then only known from 'advanced' Upper rather than Middle Palaeolithic contexts in Europe. The Howiesons Poort was termed a variation and not a well-defined industry. Goodwin and van Riet Lowe considered that more evidence was needed before the Howiesons Poort variation could be elevated to the status of an industry like the Pietersburg or Stillbay. The Howiesons Poort took its name from a small cave high on the side of a poort near Grahamstown, in the Eastern Cape Province. It had been excavated by a Jesuit schoolteacher, Rev. P. Stapleton, and the director of the local museum, a zoologist with a keen interest in archaeology, John Hewitt (Stapleton & Hewitt 1927, 1928).

The name site was reported to be a single component occurrence and this was confirmed in the 1965 re-excavation by H.J. Deacon and Janette Deacon (Deacon, J. 1979, 1995). A single component site left open the stratigraphic position of the Howiesons Poort variation in the Middle Stone Age sequence. Goodwin, who was responsible for the chapters on the Middle Stone Age and the main theoretical insights in the joint publication with van Riet Lowe (1929), was a firm believer in the progressive evolution of artefact designs. In several cases, this led him to reject stratigraphic evidence (Peers 1927, 1929; Armstrong 1931) that was contrary to his theoretical position. Thus, although he initially accepted that Peers' excavation at the Skildergat cave at Fishhoek (Goodwin & van Riet Lowe 1929:126) was adequate and had shown that the Howiesons Poort horizon occurred within the Middle Stone Age sequence, he later rejected this interpretation. Goodwin's reasoning was that the Howiesons Poort with its advanced elements was the final phase of the Middle Stone Age. The stratigraphic position of the Howiesons Poort was finally clarified in 1967 with the Singer and Wymer (1982) excavation of the Klasies River main site, the site that is the subject of this paper. At Klasies River it could be shown that the Howiesons Poort artefacts occurred as a horizon within the Middle Stone Age sequence. Subsequently, at other sites, the Howiesons Poort was found stratified between typologically different Middle Stone Age layers. Examples of Howiesons Poort occurrences in southern Africa (Fig. 1) are Apollo Cave (Wendt 1976), Border Cave (Beaumont *et al.* 1978, Beaumont 1980), Umhlatuzana (Kaplan 1989a & b, 1990) and Rose Cottage Cave (Wadley & Harper 1989; Harper 1998).

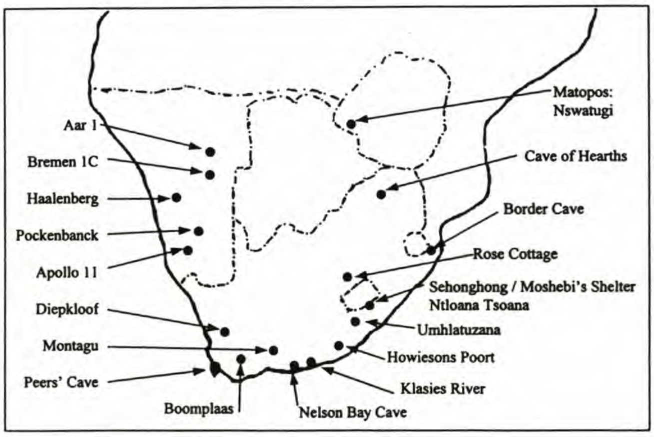


Fig. 1 Location of main Howiesons Poort occurrences in southern Africa.

It was the segment (crescent) and trapeze-shaped backed tools and burins, vouched for by the leading prehistorian of the time, the Abbé Breuil (Stapleton & Hewitt 1928), that associated the Howiesons Poort with advanced, or 'Neo-anthropic influences' (Goodwin & van Riet Lowe 1929:131). The term 'Neo-anthropic' was used to refer to the Upper Palaeolithic Cro-Magnons who, with their spectacular art and artefacts, replaced the Neanderthals in Europe. It was assumed that they were the first modern people and that through migration and diffusion their 'influences' later spread to the southern tip of Africa. However, subsequent research (Foley & Lahr 1997) has indicated that the probable centre for the evolution of modern people was in sub-Saharan Africa rather than Europe. If not the centre of evolution, southern Africa would have been part of the biogeographic province for the early dispersal. With advances in the precision with which artefact horizons and human fossils can be dated it now appears that the Howiesons Poort is almost twice as old as the earliest Upper Palaeolithic occurrences in Europe and, from remains recovered from Klasies River, we know that modern humans were present in South Africa 120 000 years ago (Deacon H.J. 1992). The Howiesons Poort can no longer be seen as the product of 'Neo-anthropic influences' emanating out of Europe but it would be equally mistaken to see the Howiesons Poort as precociously anticipating the Upper Palaeolithic. These are different and unrelated phenomena in the archaeological record that require particularistic, that is context specific, explanations.

The question posed in this paper is whether there is a link between the kind of artefacts made in the Howiesons Poort and behaviour at a level that is symptomatic of modern people. This raises the further question of what is modern behaviour? One approach would be that modern behaviour is unique to *Homo sapiens sapiens.* Darwin (1871) may have been the first to point out that humans differ from other animals in their use of language. Living humans, but not necessarily all extinct members of humankind are unique in their habitual use of symbols in speech to communicate. From an archaeological perspective modern behaviour can be defined as behaviour in which a symbolic linguistic component, that is, symbolic communication, can be identified (Davidson & Noble 1989; Chase 1991; Noble & Davidson 1996; Mellars 1998; Trask 1998). This is the viewpoint adopted here with the understanding that identifying the link between artefacts and symbolic communication is not a simple issue. Byers (1994) has developed a useful methodology. He suggests that the links between material culture and symbolic communication or symboling should be investigated in present-day societies to provide a basis for recognising modern behaviour in the past. In what he terms "action-constitutive theory" (1994:369) artefacts are seen as more than functional objects and play a semiotic role in culture. They act as "warrants" for social action and for this reason the rules or norms that guide social life also guide the production of artefacts. The exercise of rules (Byers 1994:370) generates a "surplus element" or an overdetermination of form of artefacts with respect to the 'end-goal requirements'. The surplus element can be recognised in artefacts as stylistic features of the kind discussed below. Stylistic investment varies through time and archaeologists are able to recognise this in the patterned changes in artefacts in the archaeological record.

This paper reports a study of the stylistic attributes of backed artefacts from the Howiesons Poort levels at Klasies River main site. A *chaîne opératoire* methodology has been adopted because it goes beyond typological description and emphasises the sequence of conscious choices made by the artefact makers. It allows investigation of choice, the style of making backed artefacts and behaviour. Central to the discussion in this paper is the question of whether the backed artefacts were invested with style in a way that indicates symboling. The implications are potentially important. If early modern people who were associated with the Middle Stone Age and the Howiesons Poort in South Africa can be shown to have had the ability to symbol, then it would imply that such people were modern in their behaviour. Current wisdom would accept that Upper Palaeolithic populations in Europe at 40 000 years ago exhibited symbolic behaviour (Mellars 1991; Klein 1995) but there is a reluctance to consider that early modern populations in Africa exhibited a comparable level of behaviour (Klein 1995; Mithen 1996).

The Howiesons Poort at Klasies River

Setting

The artefact samples analysed in this study come from the Howiesons Poort occurrence at Klasies River main site

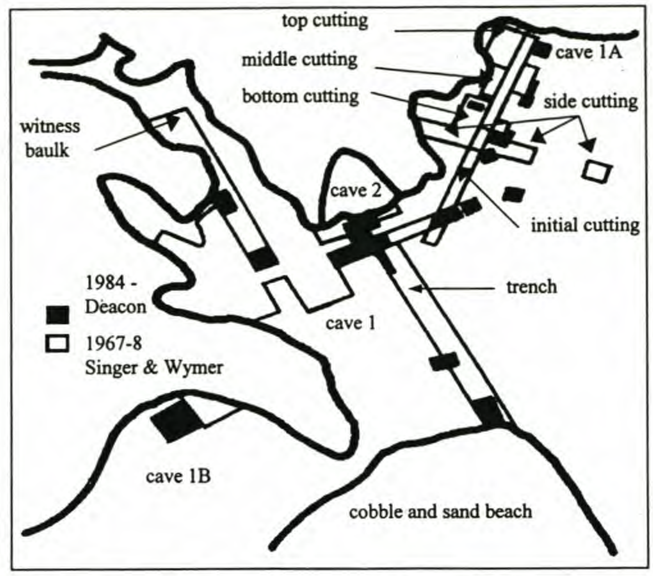


Fig. 2. Plan of Klasies River main site.

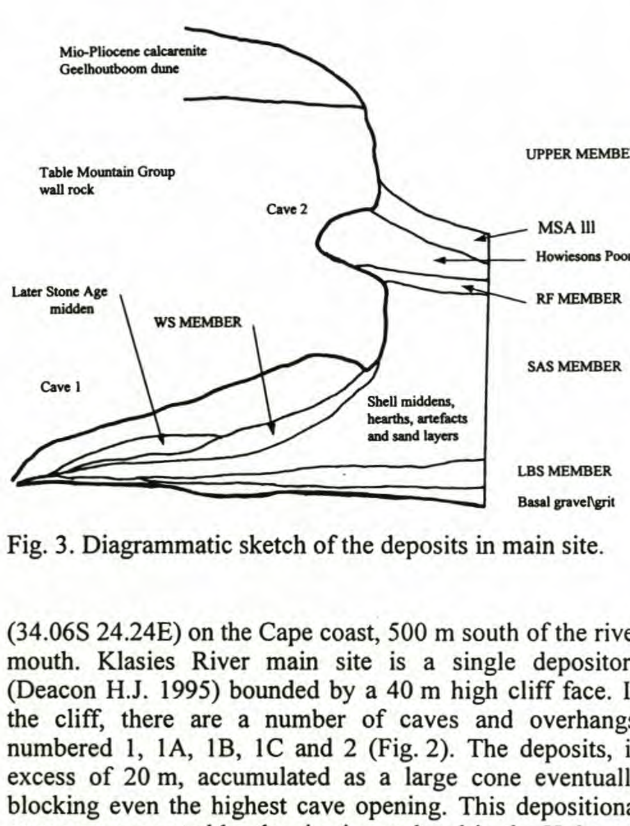


Fig. 3. Diagrammatic sketch of the deposits in main site.

(34.06S 24.24E) on the Cape coast, 500 m south of the river mouth. Klasies River main site is a single depository (Deacon H.J. 1995) bounded by a 40 m high cliff face. In the cliff, there are a number of caves and overhangs, numbered 1, 1A, 1B, 1C and 2 (Fig. 2). The deposits, in excess of 20 m, accumulated as a large cone eventually blocking even the highest cave opening. This depositional cone was truncated by the rise in sea-level in the Holocene and much of the original fill in the depository was removed. The stratigraphy is now exposed in the erosion scar of this truncation.

The deposits have been described as a series of stratigraphic members, from the base upwards, the LBS, SAS, RF and Upper members (Fig. 3). The Howiesons Poort artefacts occur in the lower half of the Upper member as exposed in caves 1A and 2. These strata consist of multiple ash and carbonised layers separated by red brown sands. Diagenesis, principally through the dissolution of shell carbonates, has caused compaction of the deposits. As a result, the thickness of Howiesons Poort layers (Deacon & Wurz 1996) range from 1.5 m in cave 1A to a maximum of some 5 m in cave 2.

Dating

As a typologically discrete marker in the Middle Stone Age sequence the dating of the Howiesons Poort has been a focus of attention. It provides a horizon for the chronological correlation of Middle Stone Age archaeological sites and sequences throughout southern Africa. The earliest Middle Stone Age occurrences are estimated to date to some 250 000 years ago (Barham & Smart 1996; Grün *et al.* 1996; McBrearty *et al.* 1996). Most Middle Stone Age sites in South Africa for which there are adequate chronological controls date to the first half of the Late Pleistocene (130 000—60 000 years ago), although the youngest occurrences have been dated to as recent as 22 000 years ago (Opperman & Heydenrych 1990). The Klasies River main site provides one of the best dated Late Pleistocene sequences. It has been central to revised thinking about the chronology of the Middle Stone Age and the Howiesons Poort and the age of associated human fossils.

At Klasies River main site an end-Last Interglacial age was indicated by initial oxygen isotope measurements on *Turbo sarmaticus* shell from the base of the Klasies River sequence, the LBS member, by Shackleton (1982). Further oxygen isotope analyses in the sequence (Deacon *et al.* 1988) and uranium disequilibrium dating of a stalagmite resting on the LBS member (Deacon *et al.* 1988) confirm the correlation of the basal deposits with MIS (Marine Isotope Stage) 5e. Bada & Deems (1975), Deacon *et al.* (1988) and Grün *et al.* (1990) suggest an age in the order of 90 000 years for the SAS member and an upper limit of about 50 000 years for the Upper member (Bada & Deems 1975). It has been shown that the layers of the Upper member are beyond the range of radiocarbon dating (Deacon *et al.* 1986).

Butzer (1982) initially correlated the Howiesons Poort layers with cryoclastic deposits at Nelsons Bay Cave and suggested they correlated with MIS 5b. This is a sub-stage older than is accepted here and Butzer's correlation on climato-stratigraphic grounds can be questioned. The oxygen isotope profile shows a correlation of the Howiesons Poort with MIS 5a and 4 (Deacon *et al.* 1988). The oxygen isotope boundary for MIS 5a–4 is placed at about 74 000 years ago (Martinson *et al.* 1987). This is reason for suggesting that the dating of the Howiesons Poort is centred on 70 000 years ago (Deacon, H.J. 1992).

Age estimates from Electron Spin Resonance (ESR) that give inconsistent results for the dating of the Howiesons Poort require further comment. Grün *et al.* (1990) used measurements on tooth enamel to date the Howiesons Poort at main site to between 60 000 and 40 000 years while at Border Cave, Grün & Stringer (1991) obtained estimates of 45 000 and 75 000 years for the same horizon. Amino acid dating of ostrich egg shell at Border Cave gives an age estimate of 80 000 years (Miller *et al.* 1992) which supports the older but not the younger Border Cave ESR estimate. At Die Kelders the Middle Stone Age deposits that may be associated with the Howiesons Poort have yielded an ESR estimate of between 60 000 and 80 000 years (Avery *et al.* 1998:272). H.J. Deacon (1992) argues that at Klasies River ESR dates should be interpreted with caution because the geochemistry of the ground water is complex and differential uptake of uranium may cause some age estimates to be less reliable than others. The same point has been made for the new dates of Die Kelders (Avery *et al.* 1998). ESR results have to be interpreted and the estimated age depends on the uranium uptake model used. It remains significant that biostratigraphy, isotope stratigraphy, amino acid dating and some ESR results all indicate a dating of 70 000 and more years for the Howiesons Poort.

There are a number of finite radiocarbon dates for Howiesons Poort occurrences. The name site was initially dated to 18 000 years (Deacon J. 1995). A wide range of subsequent age estimates included dates of between 50 000 and 30 000 years ago (Parkington 1990), such as the dates from Umhlatuzana Rock Shelter (Kaplan 1990) at about 40 000 years and Diepkloof at 29 400 and 42 400 years (Parkington 1990). These dates led Parkington (1990) to contend that there may be two Howiesons Poort type horizons, one dating to 70 000 years ago and another much younger. However, the finite age estimates should be viewed as minimum ages because of ever-present contamination (Gowlett 1987; Taylor 1996). Luminescence dating indicates that the Howiesons Poort at Diepkloof (Parkington 1998) falls between 60 000 and 74 000 years ago. Multiple assays (Deacon, J. 1995) have shown that the radiocarbon dates from the name site can be rejected, because of contamination due to complex post-depositional processes.

The Howiesons Poort has been established as a distinctive set of artefacts, a horizon and temporal marker within the Middle Stone Age sequence. Confusion on the age of this marker in the literature has been generated by the acceptance of minimum radiocarbon age estimates as finite ages. There are now sufficient data to indicate an acceptable order of age (70 000 and more years) of this marker horizon but dating methods alternative to radiocarbon do not yet have the precision to measure its duration. Estimates at Klasies River main site (Deacon & Wurz 1996) are in the 10 000 to 15 000 year range.

Analysis of the Howiesons Poort Artefacts

In 1967–68 in the initial cutting, in the top cutting and in cave 2 (Singer & Wymer 1982, fig. 2), a significant volume of material was excavated from the Howiesons Poort levels. This provided a very large sample of artefacts but not all the waste products were retained. The size of the sample makes it valuable for study of the formal tools and the sub-sample (KR1A–68) from the top cutting (n=119 336) was used for analysis. To obtain an unselected sample from the site, artefacts in the lag accumulation in cave 2 were collected from the surface rather than excavating the floor. This sample (n=14 246) includes all waste materials.

The cave 2 sample (KR2-95) was sorted into the same broad categories used by Singer and Wymer (1982). The major categories are waste, edge-damaged pieces and formal artefacts. Edge-damaged pieces are those with lateral damage visible under 10 x magnification. Waste includes pieces that have not been retouched or edge-damaged, such as chips, chunks, cores, flakes, and blades. Edge-damaged pieces and formal artefacts make up a small proportion of the assemblage (Table 1).

Retouched artefacts (0.46%) occur in low proportions in KR2–95 and at other Howiesons Poort sites (Thackeray 1992). However, the backed pieces are so distinctive that they are the *fossiles directeurs* of the Howiesons Poort. They were first described by Stapleton and Hewitt (1927, 1928) and Goodwin and van Riet Lowe (1929) as crescents and trapezoids. Other types included in the lists of Stapleton and Hewitt (1927, 1928) and Goodwin and van Riet Lowe (1929) are burins, obliquely pointed blades, trimmed points, notched stones and chisel-like scrapers as important elements. The currently accepted type list of the

Table 1. Assemblage and raw material composition of KR2-95 sample (n=14246)

	Quartzite	Silcrete	Milky Quartz	Glassy Quartz	Chalcedony	Hornfels	TOTAL	%
WASTE:								
Chips	6061		406			56	6 523	45.79
Chunks	1 261						1 261	8.85
Cores	57	7	1				65	0.46
Core rejuvenation flakes	8	1					9	0.06
Irregular flakes	3 611	15	5	2		1	3 634	25.51
Flake-blades: whole	29						29	0.20
proximal sections	69						69	0.48
Blades: whole	203	9	2	2	1	1	218	1.53
proximal sections	864	28		2	1	2	897	6.30
medial sections	886	19			1		906	6.36
distal sections	243	11		2	1		257	1.80
Subtotal	13 292	90	414	8	4	60	13 868	97.35
Subtotal (%):	93.30	0.63	2.91	0.06	0.03	0.42	97.35	
UTILISED:								
Irregular flakes	63						63	0.44
Flake-blades: whole	5						5	0.04
proximal sections	37						37	0.26
Blades: whole	26						26	0.18
proximal sections	90						90	0.63
medial sections	71						71	0.50
distal sections	20						20	0.14
Subtotal	312	0	0	0	0	0	312	2.19
Subtotal (%)	2.19	0.00	0.00	0.00	0.00	0.00	2.19	
RETOUCHED								
Segments	24	9	2	3		2	40	0.28
Intermediates	9	3	3	1		2	18	0.02
Trapezes	2	1					3	0.01
Scrapers	1						1	0.01
Points	3						3	0.02
Upper grindstone	1						1	0.13
Subtotal	40	13	5	4	0	4	66	0.46
Subtotal (%)	0.28	0.09	0.04	0.03	0.00	0.03	0.46	
TOTAL	13 644	103	419	12	4	64	14 246	
TOTAL (%)	95.77	0.72	2.94	0.08	0.03	0.45	100	

Howiesons Poort (Singer & Wymer 1982) is similar and it has been emphasised that backed pieces such as segments and trapezoids (trapezes) are found in addition to typical Middle Stone Age flake-blades and flake-blade sections (Thackeray 1992:390). In this study, the presence of a distinctive blade as opposed to flake-blade component in the assemblage is emphasised. As more Howiesons Poort assemblages have been described, it is apparent that there is considerable variability in the types and relative frequencies of retouched artefacts such as unifacial and bifacial points, denticulates and scrapers found with the backed elements.

Methodology

Typological analysis, sorting into artefact classes, is a necessary step to reduce data and to make artefact samples amenable to study (Adams & Adams 1991). There are, however, cogent criticisms of the way archaeologists construct typologies. Dunnell (1986) for example has criticised the *ad hoc* selection of attributes relating to shape to construct etic types or *fossiles directeurs*. The types listed above for the Howiesons Poort are essentially etic types and thus not necessarily constructs of the minds of the makers. While archaeologists continue to struggle with the complex principles involved in constructing typologies, similar confusion is experienced by researchers in other disciplines. Like archaeologists, cognitive scientists, for example, have to grapple with the problem of whether categories are constructed on the basis of form, function or a subconscious correlation of attributes (MacLaury 1991).

A limitation of traditional archaeological typologies, is that, in focusing on formal retouched types, important data that can inform on behaviour are lost. The whole process of manufacture of artefacts is relevant to the study of behaviour. Therefore, typology should be used in conjunction with other approaches, as is done in the *chaîne opératoire* approach (Pèrles 1992; Karlin *et al.* 1993; Schlanger 1994; Kuhn 1995; Chazan 1997). Operatory chains (Kuhn 1995) or learned operational sequences (Bar-Yosef 1994) focus on the life-history of artefacts. In this approach, the cognitive choices made by prehistoric people through their technology are emphasised. Types are viewed as stages in the life-history of an artefact but the emphasis is more holistic and concerned with understanding the dynamics of the decisions made by stone knappers. Although the adoption of a technological approach brings new insights, further methodological advances in the study of stone artefacts are both possible and needed (Chazan 1997:720).

There was more than one *chaîne opératoire* used in the production of Howiesons Poort artefacts. For instance, the production of scrapers required a different operational chain from that used for the production of backed artefacts. It is evident that a substantial proportion of the reduction sequences in the Howiesons Poort involved the production of backed artefacts. The majority of the backed artefacts were made on blade blanks which, with their distinctive small, angled, plain platforms, make up 17.44% of the KR2–95 sample. The majority (66%) of the edge-damaged pieces are blades (Table 1). Although irregular flakes and chips make up the bulk of the KR2–95 sample, they may relate to shaping of cores for the removal of blanks rather than having been intended as end-products. Although waste products are important and informative, the analysis reported here followed the 'decision steps' taken in the production and use of only the backed artefacts. The decision steps that are part of this operational sequence are the acquisition of raw material, the techniques used to produce the distinctive blade blanks, blank selection and the production and use of the backed artefacts.

Raw Material Acquisition

The raw materials recorded include quartzite, silcrete, quartz, hornfels and chalcedony. The local rock is quartzite and there is an abundant supply of suitable beach cobbles below the caves. Materials other than quartzite are classed as 'non-local'. The non-local raw material is not found in the immediate vicinity of the site. The source of the silcrete may be the Langkloof, 20 km away. Raw materials reflect choices made by the artefact makers. The Howiesons Poort at Klasies River main site (Singer & Wymer 1982) has become associated with selection for what is referred to as 'non-local' or 'exotic' raw material. This is because of the emphasis laid on the occurrence of a higher frequency of artefacts in non-local rock in the Howiesons Poort horizon than in other Middle Stone Age layers.

The trend in raw material usage through the main site sequence can be illustrated by comparing frequencies of total quartzite and non-local rock in the samples from the 1967–68 excavations (Table 2; Singer & Wymer 1982: 110). There is a seven-fold increase in the use of non-local materials in the Howiesons Poort compared with MSA III and a much greater increase compared with other stages. These relative frequencies are based on counts of cores, flakes, flake-blades and retouched artefacts but exclude chips and chunks. Nonetheless, strong selection for non-local raw materials in the Howiesons Poort is indicated.

There is a marked difference in the raw material counts for the non-retouched and retouched categories in KR1A–68 and in KR2–95 samples. In the KR1A–68 sample, 42% of the backed artefacts are in non-quartzite materials (Singer & Wymer 1982:99). In the unbiased KR2–95 sample, only a small percentage (4%) of the total industry is non-quartzite, yet 39% of the retouched artefacts are made in those materials. This confirms a high degree of selection of non-quartzite materials for retouched artefacts.

In the cave 1A sequence in layers 21 to 10, Singer & Wymer (1982:113) were able to show a trend at the assemblage level in raw material usage. This trend is also evident in the raw materials selected for making backed artefacts. In the base of the sequence there are few non-quartzite pieces but these increase upwards through the sequence. Towards the top, in layers 14 to 10, there is significant decrease in the use of silcrete and a concomitant increase in the use of quartzite. As any change in the available sources of non-local raw material is unlikely, this trend can be described as an indication of symbolic behaviour as discussed in a later section.

Table 2. Raw material usage at Klasies River main site, 1967-8 excavation

	Count (n)	Quartzite (%)	Non-Quartzite (%)
MSA IV	2 101	99.3	0.7
MSA III	6 577	96.0	4.0
HP	119 336	73.0	27.0
MSA II	95 418	98.8	1.2
MSA I	31 812	99.6	0.4

Technique of Blade Production

Flake-blade vs Blade

In the literature the terms flake-blades (Thackeray 1992:393; Avery *et al.* 1998:276) and bladelets (Singer & Wymer 1982; Kaplan 1990:12; Harper 1994, 1998) have been variously used to describe flake products in samples of Howiesons Poort artefacts. The failure to recognise the distinction between flake-blades, on the one hand, and blades, on the other, is a potential source of confusion because blades are an important component of the Howiesons Poort industry. Flake-blades and blades can be distinguished on differences in the platform characteristics. Flake-blades and convergent flakes carry typical Middle Stone Age platforms and pronounced bulbs associated with hard hammer, direct percussion. They are produced from prepared cores and carry simple or multiple facets on the platforms. Blades differ from flake-blades in having small platforms that are generally plain and an overhanging lip above a diffused bulb. Blade blanks occur in a range of sizes in the Howiesons Poort. While smaller blades are conventionally described as bladelets, in this industry there is a continuous distribution of blade sizes. Any distinction between blades and bladelets may be arbitrary and meaningless. Bladelet may be a more appropriate term to describe the much smaller blade blanks that first appear in the region in the Later Stone Age Robberg Industry. The term blade is preferred here for the larger Howiesons Poort pieces. A sample of the pieces defined as blades (n=282) from the KR95–collection was used in the analysis.

Blade Platform Description

The majority of these small blade platforms are plain (99%), carry an overhang and, as noted above, are associated with a diffuse bulb. Very few of the blade platforms were not plain but were either shattered or carried facets. The platforms are set at an angle to the main axis of the blades. The mean values of platform length and width of pieces measured (n=282) are 7.8 mm and 2.2 mm respectively (Wurz 1997). A small proportion (11%) of the blades show one or more small flake removals on the dorsal face immediately below the platform. This is interpreted as platform preparation, the thinning and shaping of the platform.

These platform features are associated with 'fracture by flexion' (Knutsson 1988) where the initiation (fracture) is caused by extreme tensile stress. The features develop particularly when the force is applied to a relatively thin piece of raw material or core (Tsirk 1979:84). Prominent in such a bending fracture process (Tsirk 1979:84) are a smooth featureless fracture surface without a bulb (Cotterell & Kamminga 1987:690, 1990), a small platform area (Cotterell & Kamminga 1990:140–42) and a lip (Tsirk 1979:85; Cotterell & Kamminga 1987, 1990). These characteristics are usually assumed to be produced by indirect percussion (Bordes & Crabtree 1969). However, Newcomer (1975) considered the same set of characteristics to be the product of either direct soft percussion or indirect percussion. Pelegrin (1991) considers that the characteristics described are an indication of direct soft percussion and not indirect percussion. Replication of the Howiesons Poort blades would provide a conclusive answer about the technique used.

Cores also carry information on the techniques used. It is noteworthy that in the KR2–95 sample there are very few 'bullet-shaped' cores of the type associated with blade production in classic Upper Palaeolithic contexts. A separate study on core forms is being undertaken.

Blade Dimensions

The dimensions used to describe the blades are length, width and height. The sample analysed includes all the whole blades as well as the proximal sections of blades on which width could be measured from the KR2–95 collection (n=177). The summary statistics for these samples are given in Table 3.

The metric parameters of the KR2–95 sample are similar to those reported from other Howiesons Poort sites. At Montagu Cave (Keller 1973:31; Volman 1981:194) the average 'flake' length ranges from 43 mm to 52 mm for quartzite 'flakes' and 26 mm to 37 mm for non-quartzite materials. In the Nelson Bay Cave Howiesons Poort sample the mean length of 'flake-blades' range from 48 mm to 50 mm (Volman 1981:216). Harper (1994:91) found that 84% of the blades in the Rose Cottage Cave sample were shorter than 35 mm and in this case, the nature of the raw material, crypto-crystalline silicates from the Drakensberg volcanics, strongly influenced blank size.

Blade Blanks Chosen for Retouch

To assess the size range of the blanks that were chosen for the production of backed artefacts, an index of selection (Chazan 1995) has been calculated. This index divides the percentage of retouched pieces in a given range by the percentage of total blade blanks in the same range. For example, 16.7% of the backed artefacts at Klasies River main site are between 36 and 40 mm long while 11.58% of the blades fall into the same class. The index of selection is 16.7/11.58 or 1.44. A low index of selection (<1) indicates that a given range is underrepresented in the retouched pieces, while an index of >1 indicates overrepresentation in the retouched pieces. The indices of selection for different length classes (Table 4) indicate that blades in the smaller range, between 20 and 45 mm, were favoured for the production of backed artefacts. Size selection was marked.

This analysis shows that whole blanks were modified into backed artefacts. In other contexts (Neely & Barton 1994) backed artefacts were commonly manufactured using the notch and snap, or microburin technique. Singer & Wymer (1982:98) noted only eighteen examples from Klasies River that may show the use of such a technique. It has also been suggested (Volman 1981:260; Thackeray 1989) that some backed artefacts may have been manufactured on sections of purposefully snapped broken blanks. In the present analysis it has been noted that, on a number of the backed artefacts (45 out of 593), the platform is visible

Table 3. Summary statistics of blades, cave 2 (n=177)

	All material			Quartzite			Non-Quartzite		
	Length	Width	Height	Length	Width	Height	Length	Width	Height
Mean (mm)	46.4	18.0	5.0	46.8	18.6	5.1	40.4	17.1	4.3
Std dev.	12.9	4.0	1.7	13.0	4.1	1.8	12.6	3.5	1.5
CV (%)	28	22	33	28	22	33	31	20	33
Minimum	23	10	2	23	10	2	27	10	2
Maximum	86	33	16	86	33	16	62	25	8
Count (n)	95	177	177	87	146	146	8	31	31

CV = Coefficient of Variation

Table 4. Index of selection for blanks indicating preferred length for the production of backed artefacts (Backed artefacts: KR1A-68 = 421, KR2-95 = 58. Blades: KR2-95=95)

Length class (mm)	% Backed artefacts (n=479)	% Blades (n=95)	Index of selection
20-25	10.23	2.11	4.86
26-30	20.25	2.11	9.62
31-35	22.13	9.47	2.34
36-40	16.70	11.58	1.44
41-45	15.45	13.68	1.13
46-50	7.72	12.63	0.61
51-55	4.38	15.79	0.28
56-60	1.88	8.42	0.22
61-65	0.84	12.63	0.07
66-70	0.42	8.42	0.05
71-75	0.00	3.16	0.00
76-80	0.00	0.00	-
81-85	0.00	0.00	-
86-90	0.00	1.05	0.00

and had not been completely removed in the backing of the artefact (Fig. 4). That in the majority of cases whole blades rather than sections were used to manufacture the artefacts is supported by the observation that one end is generally thicker than the other. The thicker end would be the bulbar end.

Backed Artefacts

The samples included in this analysis are from caves 2 (n=74) and 1A (n=519). Broken pieces that may have lost some but not all of their significant dimensions were also measured. The analysis has focused on the distribution of the continuous variables, length, width and height and on the discrete variable of shape. The summary statistics for these variables are given in Tables 5 and 6.

As the backed artefacts are design types, the most pertinent question is the degree to which they are standardised in various parameters. A measure of variability frequently used is the standard deviation. For example, J. Deacon (1972:15, 1984:282) argues that a small standard deviation for a tool class is an indication of low degree of stylistic variability. The coefficient of variation (standard deviation ÷ mean) is preferred here because it provides a measure of relative variability in the comparison of two or more data sets with varying magnitudes (Fletcher & Lock 1991:46). It has been suggested that Middle Stone Age backed artefacts are less standardised than those in the Later Stone Age (Thackeray 1992:423), but this is not supported here. By far and away the largest, and therefore the most reliable sample, the Klasies River main site Howiesons Poort backed artefact sample, shows a coefficient of variation not signifi-

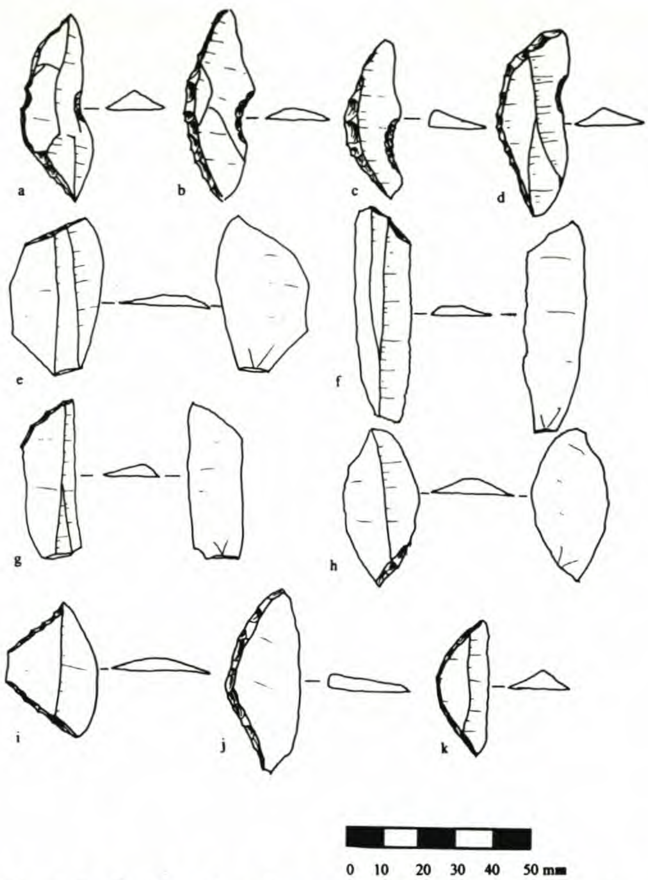


Fig. 4 Backed artefacts from cave 2 and cave 1A showing notching (top row), partial backing and the presence of platforms—stages in the reduction sequence (middle rows) and conventional forms (bottom row):
a. KR1A–68 (31619) silcrete, partially backed segment with notches, b. KR1A–68 (29638) silcrete, notched backed segment, c. KR1A–68 (28796) hornfels, notched backed segment, d. KR1A–68 (30782) quartzite, notched backed segment, e. KR1A–68 (30699) silcrete, partially backed artefact with platform visible, f. KR1A–68 (29698) quartzite, partially backed artefact with platform visible, g. KR1A–68 (31174) quartzite, partially backed artefact with platform visible, h. KR2–95 (44) silcrete, partially backed artefact with platform visible, i. KR1A–68 (30354) quartzite, half backed trapeze, j. KR1A–68 (31430) silcrete, fully backed segment, k. KR1A–68 (28436) quartzite, segment.

cantly different from that of Later Stone Age samples (Table 7). The implication is far reaching because it shows the backed artefacts from the Howiesons Poort and the Later Stone Age were designed with a comparable mental 'picture'. Backed artefacts in the Howiesons Poort and the Later Stone Age Wilton were design types of the same kind, although the Howiesons Poort backed artefacts are two to three times larger than the Wilton segments (Volman 1984:219; Thackeray 1992; Deacon, J. 1995).

It is conventional to distinguish between two classes of backed artefacts in the Howiesons Poort, segments and trapezes. The underlying assumption is that segments and trapezes are different design types and represent discrete, predetermined artefact forms (Muheisen & Wada 1995). When the backed artefacts from Klasies River main site were sorted into the two conventional classes, it was found that there were a number of pieces which did not fit the planform of either the segment or trapeze. To accommodate these 'in-between' pieces, another class, intermediates, was

Table 5 Summary statistics for backed artefacts, cave 1A

	All raw materials			Quartzite			Non-Quartzite		
	Length	Width	Height	Length	Width	Height	Length	Width	Height
Mean (mm)	36.0	16.0	4.7	36.8	17.0	5.0	35.7	14.9	4.5
Std dev.	9.2	3.4	1.4	8.9	3.1	1.4	9.4	3.6	1.3
CV (%)	25	22	29	24	19	28	26	24	29
Minimum	14	5	2	17	7	2	14	5	2
Maximum	67	28	16	67	28	16	58	27	9
Count (n)	421	519	519	235	273	273	128	246	246

CV = Coefficient of Variation

Table 6 Summary statistics for backed artefacts, cave 2 (KR2-95)

	All materials			Quartzite			Non-Quartzite		
	Length	Width	Height	Length	Width	Height	Length	Width	Height
Mean (mm)	36.6	13.7	4.3	38.7	14.0	4.4	34.8	13.0	4.3
Std Dev.	10.5	3.7	1.3	10.1	4.4	1.4	11.0	3.4	1.1
CV (%)	29	27	30	26	27	32	31	26	26
Minimum	21	8	2	22	10	2	21	8	2
Maximum	70	24	8	62	24	8	70	22	6
Count (n)	58	74	74	31	44	44	27	30	30

CV = Coefficient of Variation

Table 7 Comparison of length of Howiesons Poort and Wilton backed artefacts

SITE		**Number**	**Mean (mm)**	**Coeff. of Variation**
Howiesons Poort				
Klasies River	(Singer & Wymer 1982)	425	35.7	27
Nelson Bay Cave	(segments) (Volman 1981)	45	46.1	16
Montagu Cave	(segments) (Keller 1973)	37	29.9	23
Border Cave	(Beaumont 1978)	16	47.7	-*
Mumba	(Mehlman 1989)	27	34.2	29
Wilton				
Melkhoutboom	(Deacon, H.J. 1976)	101	11.96	24
Wilton	(Deacon, J. 1972)	54	15.44	25
Uniondale	(Leslie-Brooker 1987)	178	17.06	19

*No standard deviation available.

used (Fig. 5). As the dimensions of the segments, intermediates and trapezes are very similar, the distinctions between the forms simply serve to divide a continuum. These shapes are related or vicariant forms and they can be included in a single artefact class.

On the assumption that segments and trapezes are different modal types there has been interest in changes in the relative frequencies of segments and trapezes through time. Such patterning, where demonstrable, may indicate stylistic drift. Singer and Wymer (1982:95) state that there is a "total absence of trapezes from layers 10 to 14" at Klasies River, while Harper (1994) reports that trapezes are uncommon in the upper Howiesons Poort layers at Rose Cottage Cave. In this analysis, it was found that there are indeed substantially fewer trapezes in the upper levels in the KR1A–68 sample, but not a total absence.

Function

If backed artefacts were design types in selected materials—special pieces—then the question is what was their purpose? Examination of the thin edges opposing the backing in the KR1A–68 and KR2–95 samples provides some clues. The artefacts were examined under 10 x magnification for edge damage. Arbitrary categories of damage were recorded. They include the following: no damage, clear lateral damage ('nibbling' and minute step-flaking)

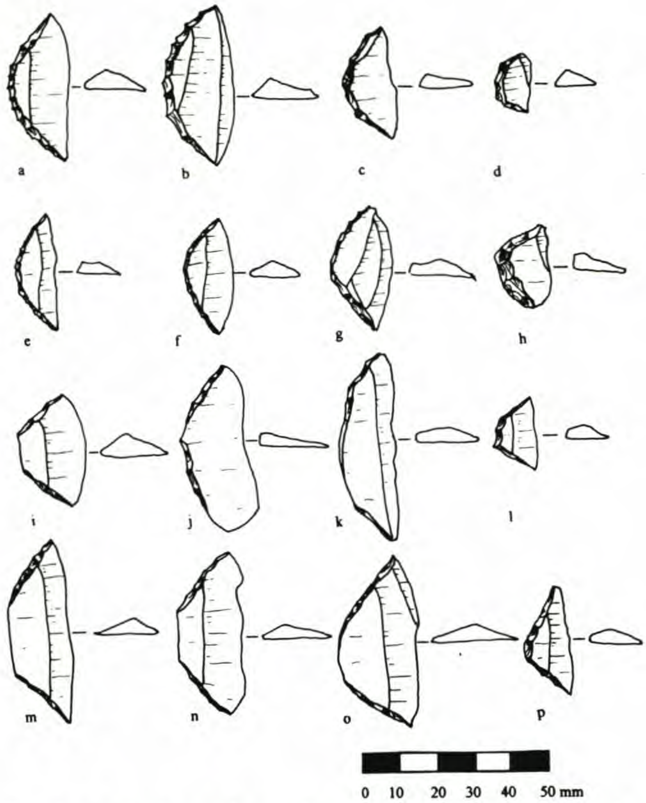


Fig. 5. Backed artefacts showing the variation in the planform:
a. KR1A–68 (28977) quartzite, segment, b. KR1A–68 (28288) chalcedony, segment, c. KR1A–68 (29512) quartzite, segment, d. KR1A–68 (28861) milky quartz, segment, e. KR2–95 (24) glassy quartz, segment, f. KR2–95 (36) silcrete, segment, g. KR1A–68 (28981) quartzite, segment, h. KR1A–68 (30620) silcrete, intermediate, i. KR1A–68 (28732) silcrete, trapeze, j. KR1A–68 (28280) quartzite, intermediate, k. KR2–95 (15) quartzite, intermediate, l. KR1A–68 (31361) silcrete, trapeze, m. KR1A–68 (31062) silcrete, trapeze, n. KR1A–68 (28799) silcrete, trapeze, o. KR1A–68 (31344) quartzite, segment, p. KR1A–68 (31342) quartzite, trapeze.

and notched damage. Of the backed artefacts, 36% showed no visible damage, 44% showed clear lateral damage and 19.4% have notches. Although edge-damage may be caused by a variety of actions, the damage on these artefacts appears consistent with use-wear.

It has been argued that these backed pieces most probably served as barbs or insets in hunting equipment (Volman 1984; Kaplan 1989b), and H.J. Deacon (1989) has argued that their size indicates that they functioned as barbs of spearheads. The notches on the backed pieces may be consistent with such a usage and may indicate hafting and binding (Singer & Wymer 1982:97). Neely & Barton (1994:284) contend that it is an assumption that backed artefacts are indicators of hunting technologies and maintain that there is neither archaeological nor ethnographic confirmation that all geometrics were used in this way. However, there are indeed instances where backed artefacts found in historical and ethnographic (Clark *et al.* 1974; Clark 1977; Deacon, J. 1992) as well as archaeological contexts (Nuzhnyi 1989, 1990) have been parts of projectile sets. Some backed artefacts may have been put to other uses, but there is no question that backed artefacts were used as armatures (Clark *et al.* 1974). Clark (1977) has also described the arrows of the San of southern Africa. This includes arrows made for Bleek and Lloyd by Jantje who grew up in Bushmanland in the last century. Examination of the inserts that are made of glass or stone shows that some of them are blunted in similar fashion to segments (J. Deacon 1992:5).

The backed artefacts from Klasies River examined in this study and also, apparently, those analysed by Harper (1994) from Rose Cottage Cave show the same kind of damage as that observed on ethnographic examples (Clark 1977:135) of stone inserts of arrows. The cutting edge of a glass segment inserted in an arrow in the South African Museum shows evidence of 'fine nibbling and retouch' (Clark 1977:135).

Evidence that Upper Palaeolithic backed artefacts were parts of composite weapons (Nuzhnyi 1989:95, 1990) is that they have been found embedded in the bones of prey species. A remarkable example is the bone point equipped with two rows of backed artefacts from the Talitskij settlement in the north eastern-part of the Russian Plains. The foremost stone insert of the bone point is described as a Gravettian point.

Much could be learned from the Howiesons Poort backed artefacts by replication and experiment. The evidence presented here, however, supports the contention that the Howiesons Poort backed artefacts were a design type, manufactured by a particular technique to predetermined standards of size and shape. A reasoned argument can be made for the backed artefacts being hafted and used as inserts in hunting equipment, specifically to arm projectiles. In the ethnographic context (Wiessner 1983) arrows are not only functional items. They are made by individuals, exchanged between individuals and are invested with symbolic meaning. The potential symbolic significance of the Howiesons Poort backed artefacts is considered in the next section.

Towards an Interpretation of the Howiesons Poort

The majority of interpretations of the Howiesons Poort have been made within an ecological paradigm (Clark 1959; Ambrose & Lorenz 1990; Bousman 1993; Deacon, H.J. 1995). These have correlated the Howiesons Poort with habitat and demographic changes caused by large scale climate change of MIS 5a–4. Dynamic cultural changes within the Middle Stone Age tradition have also been offered as an interpretation for the Howiesons Poort (Beaumont 1978; Wadley & Harper 1989; Kaplan 1990), although there has been little explicit theoretical discussion of the nature of these changes.

Inhibiting interpretation have been concerns with dating, correlation and sampling problems (Volman 1984:207; Thackeray 1992; Harper 1994) of an empirical rather than theoretical nature. The viewpoint taken here is that there is now a sufficient degree of consensus on the culture-stratigraphy of the Middle Stone Age, particularly for a marker like the Howiesons Poort, to warrant attempts at interpretation that are more explicitly grounded in theory. In particular, the concepts of style and symbolism can be used to consider the meaning of the Howiesons Poort within the wider context of the evolution of modern behaviour.

Style and Symbolism

In lithic studies, the main theoretical discussions have focused on the issue of style but there is no simple universally accepted definition of style. Conkey and Hastorf (1990:1) emphasise that although there are many studies of style, the meaning of style is often ambiguous. Here the goal is to discuss the definition and identification of style in terms of symbolic communication or modern behaviour.

Most discussions regard the active, communicative and conscious aspects of style as significant in the studies of behaviour (Sackett 1977, 1982, 1986, 1990; Wiessner 1983, 1984, 1985, 1990). Active style (Sackett 1977) or emblemic style (Wiessner 1983) is recognised when an artefact was intended to serve as a marker of social identity or to communicate a social message. Although not always explicitly stated (Duff *et al* 1992) active style can be equated with symbolism (Chase 1991; Sackett 1982, 1986; Plog 1995). Whereas active style has a clear purpose, Sackett (1990:36) has suggested that passive or isochrestic style has no such specific purpose. Isochrestic style (Sackett 1990:33) underlies much of what archaeologists observe as cultural change or drift and is the result of the selection from the many options available for the manufacture of the artefacts that typify an industry. In as far as the goal was not necessarily communication, Sackett does not regard isochrestic style as symbolic (*contra* Byers 1994:377). However, appraising whether communication through artefacts was deliberate or not, is potentially fraught with problems (Close 1989:9; Sackett 1990:35). A solution to this methodological difficulty is to focus on the semiotic role of artefacts in culture as has been done by Byers (1994; Wynn 1998) in his action-constitutive theory.

According to this theory he has designated two kinds of style. Style 1 is termed 'material behaviour' and style 2, 'material actions'. Material behaviour is recognised when the form of artefacts is dictated solely by function. Such behaviour, he suggests, would be associated with non-modern or archaic humans. In contrast, 'material actions' are governed by social rules. This category can be recognised in the archaeological record when a single outcome or end-goal can be reached via different sets of rules. For instance, there are many possible forms that stone projectile points can take, but the form chosen is dictated by social rules. An important corollary of the occurrence of style 2 assemblages is that, as social rules change, material culture changes in a volatile fashion. It is this volatility that patterns the archaeological record and is recognised by Byers (1994) as indicative of modern behaviour.

Style 2 has long been recognised in the non-functional attributes of artefacts (Close 1979, 1989; Friss-Hansen 1990; Chase 1991). It is recognised in ways that include the presence of standardisation and the imposition of form on artefacts. These characteristics imply symbolic conceptualisation and symbolic communication and, to some authorities, language (Chase & Dibble 1987; Dibble 1989; Mellars 1991, 1998). Byers' (1994) action-constitutive theory can provide a theoretical underpinning for the discussion of the behaviour of early modern humans in the Late Pleistocene in South Africa.

The Howiesons Poort and Symbolic Behaviour.

In the analysis of the backed artefacts from the Klasies River main site, an attribute that can be described as an indication of style 2, or non-functional elaboration, is the preferential selection of non-local raw materials. The choice of raw materials in the Howiesons Poort has no functional significance because the backed artefacts in local and non-local material have the same attributes (Tables 5 & 6). This means that the choice of raw material has been dictated by social convention. A plausible reason for the use of non-local raw material is that they added value to the composite artefacts through the cost of procurement. In ethnographic context, projectile points are active communicators of style (Wiessner 1983) because they are exchange items. This is the basis for the argument that the Howiesons Poort backed artefacts had a similar role. H.J. Deacon (1989, 1995) has argued that the added value of non-local materials indicates that these special backed artefact in the Howiesons Poort were reciprocal exchange items.

The attribute analysis of the backed artefacts from Klasies River main site establishes that the Howiesons Poort backed artefacts are design types (Deacon, J. 1972) that are as standardised as those in the Later Stone Age. Byers (1994) considers standardisation as evidence of symboling, because standardisation indicates that behaviour has been guided by conventional social rules. Because this particular type of standardised artefact is restricted to Howiesons Poort levels, this is an indication of stylistic change, a behaviour guided by conventional social rules.

Chase (1991:207) has cautioned that standardisation can only be interpreted as evidence of symbolic behaviour if technology can be excluded as determinant. Blade technology *sensu lato,* as Chase has argued, can lead to the production of standardised forms. This cautionary argument is not relevant in the case of the Howiesons Poort artefacts because, of the wide range of blade sizes produced, only a narrow range was selected (Table 4) for the production of the backed artefacts. Another caution offered by Chase (1991) and Mellars (1991) is that standardisation is not an indication of symbolic behaviour if the standardisation is determined by the exigencies of function, as in hafting. Attachment to a handle may indeed require some degree of standardisation of size parameters to ensure a secure fit. However, there is archaeological evidence (Odell 1988; Boëda *et al.* 1996) for the hafting of a wide range of artefacts in prehistoric times. Clearly in the Middle Stone Age there was a range of possible hafted-backed-tool shapes, each derived by following a different of set of rules. The choice of which to use was not limited by the exigencies of hafting but by changing social rules. The standardised backed artefacts of the Howiesons Poort are held to indicate symboling and thus modern behaviour.

Concluding Remarks

The chain of operations followed in the making of the Howiesons Poort backed artefacts goes beyond that necessary for purely functional tasks. Symboling can be traced through the decisions made in the choice of raw materials and in selection of blanks of a specific size range for the production of preconceived design types. The fact that backed artefacts became redundant in later phases of the Middle Stone Age is evidence for the volatility in fashion that is characteristic of style 2, denoting modern behaviour. According to the criteria set by Byers (1994:396) and (Mellars 1998:90) the Howiesons Poort can be equated with modern or symbolic behaviour.

Does this mean that symbolic behaviour was restricted to the Howiesons Poort and later phases of the Middle Stone Age or was it an attribute of all early modern humans? The relationship between biology and behaviour is complex (Chase & Dibble 1990) but there is no *a priori* reason why all early modern people were not behaviourally modern. People with symbolic behaviour make choices in selecting and changing the media of expression. Change in, and the intensity in the use of, symbols would reflect in the archaeological record in different kinds of material culture. Symbolic communication was 'switched on' in the Howiesons Poort in a way that is obvious in stone artefacts. The symboling behaviour this signifies would not have disappeared although the messages communicated and the intensity of the use of symbols may have differed in earlier and later times.

There are other indications that symboling was characteristic of the whole Late Pleistocene Middle Stone Age. Notable is the occurrence of red ochre throughout this time range. Not only was ochre collected and returned to the site but there is evidence in the ochre 'pencils' with ground facets that it was powdered for use. Ochre may have had many uses but the possibility that it was used as a body paint, and therefore had served a symbolic purpose, cannot be excluded. There are clear parallels in the symbolic use of ochre in Later Stone Age sites and in the ethnographic present.

The conventional view is that symbolic behaviour only became recognisable in the archaeological record at the beginning of the Upper Palaeolithic, 40 000 years ago (Klein 1995; Holden 1998). This has been labelled the 'symbolic explosion' (Mellars 1991). The assumption has been that sapient behaviour manifested itself in the archaeological record by the appearance of a 'package' of traits: blade and burin technology, art and ornaments and elaborate burials, in the Upper Palaeolithic. To hold that the Upper Palaeolithic had more than regional significance, however, is parochial and misleading. The traits that characterise the Upper Palaeolithic, and that distinguish it from the Middle Palaeolithic, cannot be taken as universal markers for the emergence of symbolic behaviour. The Upper Palaeolithic illustrates intensification in the use of symbols that may be associated with crowding or density dependent behaviour. While the 'package' is acceptable evidence for symbolic behaviour, the markers are only relevant in the context of western Eurasia. The Upper Palaeolithic was not a global stage and no equivalent of the Upper Palaeolithic has been recorded in sub-Saharan Africa or other regions outside the Upper Palaeolithic spread. In such regions, the emergence of symbolic behaviour would be indicated in different context specific markers. The importance of the evidence of the Howiesons Poort is that symbolic behaviour can be recognised in an African context at a significantly earlier time. Then, as now, symbolic communication was an essential in daily life.

Acknowledgements

This paper follows on research being undertaken for a DPhil degree in the Department of Archaeology, University of Stellenbosch. I would like to thank my supervisor, Prof. H.J. Deacon, for guidance and stimulating discussion. Financial assistance from the Centre for Scientific Development, the Harry Crossley Bursary Fund and the L.B.S. Leakey Foundation is gratefully acknowledged. The Struwig Trust facilitated research in the field and the South African Museum made collections available for study.

References

Adams, W.Y. & Adams, E.W. 1991. Archaeological typology and practical reality: a dialectical approach to artefact classification and sorting. Cambridge: Cambridge University Press.

Ambrose, S.H. & Lorenz, K.G. 1990. Social and ecological models for the Middle Stone Age in Southern Africa. In: P. Mellars (ed.) The emergence of modern humans: 3–33. Edinburgh: Edinburgh University Press.

Armstrong, A.L. 1931. Rhodesian archaeological expedition (1929): excavations in Bambata cave and researches on prehistoric sites in southern Rhodesia. Journal of the Royal Anthropological Institute 61:239–276.

Avery, G., Cruz-Uribe, K., Goldberg, P., Grine, F.E., Klein, R.G., Lenardi, M.J., Marean, C.W., Rink, W.J., Schwarcz, H.P., Thackeray, A. & Wilson, M.L. 1998. The 1992–1993 excavations at the Die Kelders Middle and Later Stone Age cave site, South Africa. Journal of Field Archaeology 24:263–291.

Bada, J.L. & Deems, L. 1975. Accuracy of dates beyond the 14–C dating limit using the aspartic acid racemization reaction. Nature 255:218–219.

Barham, L.S. & Smart, P.L. 1996. An early date for the Middle Stone Age of central Zambia. Journal of Human Evolution 3:287–290.

Bar-Yosef, O. 1994. Beyond stone tools. Review of: Stringer, C. & Gamble, C. 1993. In search of the Neanderthals: solving the puzzle of human origins. London: Thames & Hudson. Cambridge Archaeological Journal 4:107–109.

Beaumont, P.B. 1978. Border Cave. Cape Town: University of Cape Town, PhD thesis.

Beaumont, P.B. 1980. On the age of Border Cave hominids 1-5. Palaeontologica Africana 23:21–33.

Beaumont, P.B., De Villiers, H. & Vogel, J.C. 1978. Modern man in sub-Saharan Africa prior to 49 000 years BP: a review and evaluation with particular reference to Border Cave. South African Journal of Science 74:409–419.

Boëda, E., Connan, J., Dessort, D., Muhesen, S., Mercier, N., Valladas, H. & Tisnérat, N. 1996. Bitumen as a hafting material on Middle Palaeolithic artefacts. Nature 380:336-338.

Bordes F. & Crabtree, D. 1969. The Corbiac blade technique and other experiments. Tebiwa 12:1-21.

Bousman C.B. 1993. Hunter-gatherer adaptations, economic risk and tool design. Lithic Technology 18: 59–86.

Butzer, K.W. 1982. Geomorphology and sediment stratigraphy. In: Singer, R. & Wymer, J.J. (eds) The Middle Stone Age at Klasies River Mouth, South Africa:33–42. Chicago: University of Chicago Press.

Byers, A.M. 1994. Symboling and the Middle-Upper Palaeolithic transition: a theoretical and methodological critique. Current Anthropology 35:369-400.

Chase, P.G. 1991. Symbols and Palaeolithic artefacts: style, standardisation, and the imposition of arbitrary form. Journal of Anthropological Archaeology 10:193–214.

Chase, P.G. & Dibble, H.L. 1987. Middle Palaeolithic symbolism: a review of current evidence and interpretations. Journal of Anthropological Archaeology 6:263–96.

Chase, P.G. & Dibble, H.L. 1990. On the emergence of modern humans. Current Anthropology 31:58–59.

Chazan, M. 1995. The language hypothesis and lithic analysis. Current Anthropology 36:749–768.

Chazan, M. 1997. Lead Review. Redefining Levallois.

Journal of Human Evolution 33:719–735.

Clark, J.D. 1959. The prehistory of southern Africa. Harmondsworth: Penguin.

Clark, J.D. 1977. Interpretations of prehistoric technology from ancient Egyptian and other sources. Paléorient: 127–50.

Clark, J.D., Phillips, J.L. & Staley, P.S. 1974. Ancient Egyptian bows and arrows and their relevance for African Prehistory. Paleorient 2:323–88.

Close, A.E. 1979. The identification of style in lithic artefacts. World Archaeology 10:223–237.

Close, A.E. 1989. Identifying style in stone artefacts: a case study from the Nile Valley. In: Henry, D.O. & Odell, G.H. (eds) Alternative approaches to lithic analysis:3–26. Archaeological papers of the American Anthropological Association Number 1.

Conkey, M.W. & Hastorf, C. 1990. The uses of style in archaeology. Cambridge: Cambridge University Press.

Cotterell, B. & Kamminga, J. 1979. The mechanics of flaking. In: Hayden, B. (ed.) Use-wear analysis: 97–112. New York : Academic Press.

Cotterell, B. & Kamminga, J. 1987. The formation of flakes. American Antiquity 52(4):675–708.

Cotterell, B. & Kamminga, J. 1990. Mechanics of pre-industrial technology. New York: Cambridge University Press.

Darwin, C. 1871. The descent of man. London: John Murray.

Davidson, I. & Noble, W. 1989. The archaeology of perception: traces of depiction and language. Current Anthropology 30: 125–55.

Deacon, H.J. 1989. Late Pleistocene palaeoecology and archaeology in the southern Cape, South Africa. In: Mellars, P. & Stringer, C. (eds) The human revolution: behavioural and biological perspectives on the origins of modern humans:547–564. Edinburgh: Edinburgh University Press.

Deacon, H.J. 1992. Southern Africa and modern human origins. Philosophical Transactions of the Royal Society, London B 337:177–183.

Deacon, H.J. 1995. Two Late Pleistocene–Holocene archaeological depositories from the southern Cape, South Africa. South African Archaeological Bulletin 50:121–131.

Deacon, H.J., Geleijnse, V.B., Thackeray, A.I., Thackeray, J.F., Tusenius, M.L. & Vogel, J.C. 1986. Late Pleistocene cave deposits in the southern Cape: current research at Klasies River. Paleoecology of Africa 17:31–37.

Deacon, H.J., Talma, A.S. & Vogel, J.C. 1988. Biological and cultural development of Pleistocene people in an Old World southern continent. In: Prescott, J.R. (ed.) Early man in the southern hemisphere: S23–S31. Adelaide: Department of Physics and Mathematical Physics, University of Adelaide.

Deacon, H.J. & Wurz, S. 1996. Klasies River main site, cave 2: a Howiesons Poort occurrence. In: Pwiti, G. & Soper, R. (eds) Aspects of African archaeology: 213–218. Harare: University of Zimbabwe Publications.

Deacon, J. 1972. Wilton: an assessment after fifty years. South African Archaeological Bulletin 27:10–45.

Deacon, J. 1979. The Howiesons Poort and related industries in southern Africa with special reference to the name site collection. Paper presented at a workshop of the Southern African Association of Archaeologists, Stellenbosch.

Deacon, J. 1984. The Later Stone Age of southernmost Africa. British Archaeological Reports, International Series 213, Oxford.

Deacon, J. 1992. Arrows as agents of belief amongst the /Xam Bushmen. Cape Town: South African Museum, Margaret Shaw lecture 3.

Deacon, J. 1995. An unsolved mystery at the Howieson's Poort name site. South African Archaeological Bulletin 162:110–120.

Dibble H.L. 1989. The implication of stone tool types for the presence of language during the Lower and Middle Palaeolithic. In: Mellars, P., & Stringer, C. (eds) The human revolution: 415–43. Edinburgh: Edinburgh University Press.

Duff, A.I., Clark, G.A. & Chadderdon, T.J. 1992. Symbolism in the early Palaeolithic: a conceptual odyssey. Cambridge Archaeological Journal 2:211–229.

Dunnell, R.C. 1986. Methodological issues in Americanist artifact classification. Advances in Archaeological Method and Theory 9:149–207.

Fletcher, M. & Lock, G.R. 1991. Digging numbers—elementary statistics for archaeologists. Oxford: Oxbow Books.

Foley, R. & Lahr, M. 1997. Mode 3 technologies and the evolution of modern humans. Cambridge Archaeological Journal 7:3—36.

Friss-Hansen, J. 1990. Mesolithic cutting arrows: functional analysis of arrows used in the hunting of large game. Antiquity 64:494–504.

Goodwin, A.J.H. & van Riet Lowe, C. 1929. The Stone Age cultures of South Africa. Annals of the South African Museum 27.

Gowlett, J.A.J. 1987. The coming of modern man. Antiquity 61:210–219.

Grün, R, Shackleton, N.J. & Deacon, H.J. 1990. Electron-spin resonance dating of tooth enamel from Klasies River Mouth Cave. Current Anthropology 31:427–432.

Grün, R. & Stringer, C.B. 1991. Electron spin resonance dating and the evolution of modern humans. Archaeometry 33:153–199.

Grün, R., Brink, J.S., Spooner, N.A., Taylor, L., & Stringer, C.B., Fransiscus, R.G., & Murray, A.S. 1996. Direct dating of the Florisbad hominid. Nature 382:500–501.

Harper, P.T. 1994. The Middle Stone Age sequence at Rose Cottage Cave: a search for continuity and discontinuity. Johannesburg: University of the Witwatersrand, Masters thesis.

Harper, P.T. 1998. The Middle Stone Age sequences at Rose Cottage Cave: a search for continuity and discontinuity. South African Journal of Science 93:470–475.

Holden, C. 1998. No last word on language origins. Science 282:1455-1458.

Kaplan, J. 1989a. The Middle Stone Age at Umhlatuzana rock shelter with emphasis on layers 28–22. Unpublished report: Natal Museum, Pietermaritzburg.

Kaplan, J. 1989b. 45 000 years of hunter-gatherer history as seen from Umhlatuzana rock shelter. Cape Town: University of Cape Town, Masters thesis.

Kaplan, J. 1990. The Umhlatuzana rock shelter sequence: 100 000 years of Stone Age history. Natal Museum Journal of Humanities 2:1–94.

Karlin, C., Ploux, S., Bodu, P. & Pigeot, N. 1993. Some socio-economic aspects of the knapping process among groups of hunter-gatherers in the Paris Basin area. In: Berthelet, A. & Chavaillon, J. (eds) The use of tools by human and non-human primates:318–337. Oxford:

Clarendon Press.

Keller, C.M. 1973. Montagu Cave in prehistory: a descriptive analysis. University of California Anthropological Records 28:1–98.

Klein R.G. 1995. Anatomy, behaviour and modern human origins. Journal of World Prehistory 9:167–98.

Knutsson, K. 1988. Making and using stone tools—the analysis of the lithic assemblages from Middle Neolithic sites with flint in Västerbotten, Sweden. Uppsala: University of Uppsala, PhD thesis.

Kuhn, S.L. 1995. Mousterian lithic technology, an ecological perspective. Princeton: Princeton University Press.

Leslie-Brooker, M. 1987. An archaeological study of the Uniondale rockshelter, Albany District, Eastern Cape. Stellenbosch: University of Stellenbosch, Masters thesis.

MacLaury, R.E. 1991. Prototypes revisited. Annual Review of Anthropology 20:55–74.

Martinson, D.G., Pisias, N.G., Hays, J.D., Imbrie, J., Moore, T.C., & Shackleton, N.J. 1987. Age dating and orbital theory of the ice ages: development of a high-resolution 0 to 300 000–year chronostratigraphy. Quaternary Research 27:1–29.

McBrearty, S., Bishop, L. & Kingston, J. 1996. Variability in traces of Middle Pleistocene hominid behavior in the Kapthurin Formation, Baringo, Kenya. Journal of Human Evolution 30:563–580.

Mehlman, M.J. 1989. Later quaternary archaeological sequences in northern Tanzania. Ann Arbor: University of Illinois ar Urbana-Champaign, PhD thesis.

Mellars, P.A. 1991. Cognitive changes and the emergence of modern humans. Cambridge Archaeological Journal 1:63–76.

Mellars, P. 1998. Modern humans, language and the 'symbolic explosion'. Cambridge Archaeological Journal 8 (1):63-90.

Miller, G.H., Beaumont, P.B., Jull, A.J.T. & Johnson, B. 1992. Pleistocene geochronology and palaeothermometry from protein diagenesis in ostrich eggshells: implications for the evolution of modern humans. Philosophical Transactions of the Royal Society, London B 337:149–158.

Mithen, S. 1996. The prehistory of the mind. London: Thames & Hudson.

Muheisen, M. & Wada, H. 1995. An analysis of the microliths at Kharaneh IV, phase D, square A20/37. Paléorient 21:75–95.

Neely, M.P. & Barton, C.M. 1994. A new approach to interpreting late Pleistocene microlith industries in southwest Asia. Antiquity 68:275–88.

Newcomer, M.H. 1975. 'Punch technique' and Upper Paleolithic blades. In: Swanson, E. (ed.) Lithic Technology: making and using stone tools. The Hague: Mouton Publishers:97-104.

Noble, W. & Davidson, I. 1996. Human evolution, language and mind: a psychological and archaeological inquiry. Cambridge: Cambridge University Press

Nuzhnyi, D.J. 1989. L'utilisation des microlithes géométriques et non géométriques comme armatures des projectiles. Bulletin de la Société Préhistorique Francaise 86 (3):88–96.

Nuzhnyi, D.J. 1990. Projectile damage on Upper Paleolithic microliths. Use of bow and arrow among Pleistocene hunters in the Ukraine. In: Proceedings of the International Conference on lithic use-wear analysis, 15^{th}–17^{th} February 1989 in Uppsala, Sweden :113–124. Societas Archaeologica Uppsaliensis, Uppsala 1990.

Odell, G.H. 1988. Addressing prehistoric hunting practices through stone tool analysis. American Anthropologist 90:335-356.

Opperman, H. & Heydenrych, B. 1990. A 22 000 year-old Stone Age camp site with plant food remains from the north-eastern Cape. South African Archaeological Bulletin 45:93–99.

Parkington, J.E. 1990. A critique of the consensus view on the age of Howieson's Poort assemblages in South Africa. In: Mellars, P. (ed.) The emergence of modern humans: an archaeological perspective:34-55. Edinburgh: Edinburgh University Press.

Parkington, J.E. 1998. Diepkloof. In: Deacon, H.J. (ed.) Excursion guide to sites north and east of Cape Town:78–79. Sun City, South Africa:Dual Congress.

Peers, B. 1927. Excavation report of 1927 on Peers' Cave. Cape Town: Unpublished manuscript, South African Museum.

Peers, B. 1929. Preliminary report on the archaeology of the Fish Hoek—Noord Hoek Valley. Cape Town: Unpublished manuscript, University of Cape Town Libraries.

Pelegrin, J. 1991. Sur une recherche technique experimentale des techniques de debitage laminaire. Actes du Colloque International 'Expérimentation en archéologie: bilan et perspectives' les Avril 1988:118-167.

Perlès, C. 1992. In search of lithic strategies: a cognitive approach to prehistoric chipped stone assemblages In: Garding, J & Peebles, C.S. (eds) Representations in archaeology:223–250. Bloomington: Indiana University Press.

Plog, S. 1995. Approaches to style: complements and contrasts. In: Carr, C. & Neitzel, J.E. (eds) Style, society and person, archaeological and ethnological perspectives:269–383. London: Plenum Press.

Sackett, J.R. 1977. The meaning of style in archaeology: a general model. American Antiquity 42:369–80.

Sackett, J.R. 1982. Approaches to style in lithic archaeology. Journal of Anthropological Archaeology 1:59–112.

Sackett, J.R. 1986. Isochrestism and style: a clarification. Journal of Anthropological archaeology 5:266–77.

Sackett, J.R. 1990. Style and ethnicity in archaeology: the case for isochrestism. In: Conkey, M. & Hastorf, C. (eds) The uses of style in archaeology:32–43. Cambridge: Cambridge University Press.

Schlanger, N. 1994. Mindful technology: unleashing the *chaîne opératoire* for an archaeology of mind. In: Renfrew, C. & Zubrow, E.B.W. (eds) The ancient mind: elements of cognitive archaeology:143–51. Cambridge: Cambridge University Press.

Shackleton, N.J. 1982. Stratigraphy and chronology of the Klasies River Mouth deposits: oxygen isotope evidence. In: Singer, R and Wymer, J.J. (eds) The Middle Stone Age at Klasies River Mouth in South Africa:194-199. Chicago: University of Chicago Press

Singer, R. & Wymer, J. 1982. The Middle Stone Age at Klasies River Mouth in South Africa. Chicago: Chicago University Press.

Stapleton, P. & Hewitt, J. 1927. Stone implements from a rock-shelter at Howieson's Poort near Grahamstown. South African Journal of Science 24:574–587.

Stapleton, P. & Hewitt, J. 1928. Stone implements from Howieson's Poort, near Grahamstown. South African Journal of Science 25:399–409.

Taylor, R.E. 1996. Radiocarbon dating: the continuing revolution. Evolutionary Anthropology 4:169–181.

Thackeray, A.I. 1989. Changing fashions in the Middle Stone Age: the stone artefact sequence from Klasies River main site, South Africa. The African Archaeological Review 7:33–57.

Thackeray, A.I. 1992. The Middle Stone Age south of the Limpopo River. Journal of World Prehistory 6:385–431.

Trask, L. 1998. Language origins: a linguist's view. Cambridge Archaeological Journal 8:70–72.

Tsirk, A. 1979. Regarding fracture initiation. In: Hayden, B. (ed.) Lithic use-wear analysis: 83–96. New York: Academic Press.

Volman, T.P. 1981. The Middle Stone Age in the southern Cape. Chicago: University of Chicago, PhD thesis.

Volman, T.P. 1984. Early prehistory of southern Africa. In: Klein, R.G. (ed.) Southern African prehistory and palaeoenvironments:169–220. Rotterdam : Balkema.

Wadley, L. & Harper, P. 1989. Rose Cottage cave revisited: Malan's Middle Stone Age collection. South African Archaeological Bulletin 44:23–2.

Wendt, W.E. 1976. 'Art Mobilier' from the Apollo 11 cave, south West Africa: Africa's oldest dated works of art. South African Archaeological Bulletin 31:5–11.

Wiessner, P. 1983. Style and social information in Kalahari San projectile points. American Antiquity 48:253–276.

Wiessner, P. 1984. Reconsidering the behavioural basis of style. Journal of Anthropological Archaeology 3:190–234.

Wiessner, P. 1985. Style or isochrestic variation? A reply to Sackett. American Antiquity 50:160–166.

Wiessner, P. 1990. Is there a unity to style? In: Conkey, M. & Hastorf, C. (eds) The uses of style in archaeology: 5–17. Cambridge: Cambridge University Press.

Wurz, S. 1997. The Howiesons Poort at Klasies river: from artefacts to cognition. Stellenbosch: University of Stellenbosch, Masters Thesis.

Wynn, T. 1998. Did *Homo erectus* speak? Cambridge Archaeological Journal 8(1):78-81.